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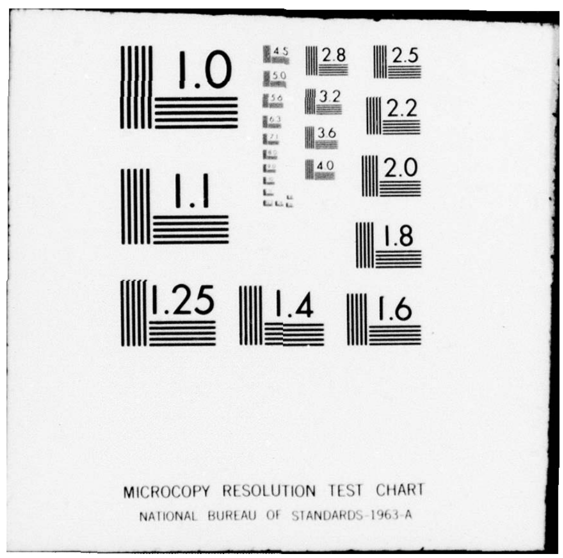
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PHOTOLITHOGRAPHIC TECHNIQUES FOR SURFACE ACOUSTIC WAVE (SAW) DEVICES.

(10) A. W. DOZIER

Volume 1. Process Specification.

GROUND SYSTEMS GROUP
HUGHES AIRCRAFT COMPANY
FULLERTON, CALIFORNIA 92634

July 1975 to 31 December 1978

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NOTICES

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This project has been accomplished as part of the US Army Manufacturing and Technology Program, which has as its objective the timely establishment of manufacturing processes, techniques or equipment to insure the efficient production of current or future defense programs.

Disclaimers

Disposition

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Tapped Delay Line Filters
Pulse Compression Filters
SAW Processing
SAW Packaging

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

The object of the program was the establishment of a production capability for surface acoustic wave devices of varied design and material for the purpose of meeting estimated military needs for a period of two years after the completion of the contract, and to establish a base and plans which may be used to meet expanded requirements. The primary requirement was the pilot line production of devices that are reliable, reproducible, and low cost.

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SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

The first phase of this program required the design, fabrication and testing of a total of 60 prototype bandpass, tapped delay line and pulse compression SAW filters on both lithium niobate and ST-quartz. The First Engineering Phase (Phase I) electrical testing demonstrated that the device designs generally met the specifications imposed by the program. Deviations from specification, which required additional test to optimize the levels of padding and/or shunt resistance and capacitance, were resolved during the Second Engineering Phase (Phase II) for the PC-Q, PC-LN and TDL-200. Deviations from the insertion loss specification occurred with the BP-LN and TDL-100 designs. In the former case, a redesign excluding the program-specified multi-strip coupler, was theoretically evaluated. In the latter case, as pointed out in the Hughes proposal, a theoretical analysis precluded the possibility of a specification accommodation. It was necessary to revise the specification for both designs since the customer insisted on utilization of the multistrip coupler in the BP-LN.

Testing of modified semiconductor pin packages during Phase II demonstrated these to be suitable, cost-effective replacements for the machined chassis employed for Phase I. A quartz orientation problem was highlighted in Phase I and negotiated during Phase II. The quartz vendor implemented an effective screening procedure for the off-orientation problem. However, problems with this vendor continued in the form of substrate surface defects. Other major yield problems encountered during these portions of the program resulted from the dicing and mask making operations. The Phase I and Phase II efforts resulted in a finalized layout, electrical specification and test procedure for the Third Engineering Phase (Phase III).

Phase III involved fabrication of a larger quantity (50 ea.) of confirmatory devices which were sampled at a high rate and subjected to rigorous life and environmental testing. Phase III was successfully completed with delivery and acceptance of the confirmatory samples. The device configuration is detailed as it existed for Phase III along with assembly details, results and conclusions from the Confirmatory Sample production run (Phase III).

The Fourth Engineering Phase (Phase IV) of the program was pilot line production effort of 150 each of the devices scheduled to be delivered. Solder sealing was identified as a problem area during Phase IV for SAW devices in Phase III packages. New solder seal screening and processing procedures were investigated. In addition, alternative sealing approaches were evaluated. These procedures, Tungsten Inert Gas (TIG) and projection and seam welding were demonstrated to be more compatible with SAW processing. They are especially suitable for high volume production.

Phase IV pilot line production was completed with the delivery of approximately 150 of each of the device types. Some devices were shipped short due to the inability to locate a second source for projection welding, and the extended lead time in reprocurement of packages capable of being sealed by alternate procedures.

Data from Phases I through IV are presented in the Technical and Operational volume of the Final Report. Pilot Line process flow and related documentation are presented in the Process Specification Volume of the Final Report. All inspection positions, pilot run yields, and quality control procedures for Phase IV are presented in the Quality Control Volume of the Final Report. Cost analysis and labor distribution for all facets of the program are covered in a non-distributable volume of the final report.

The Program will include preparation of a General Report, which will consist of an analysis of equipment and facilities required to produce SAW devices of the type produced in the Pilot Run at a rate of 500 per month. In addition, an Industry Demonstration was prepared which verbally and visually presented all facets of the MMT program through the Pilot Run.

CONTENTS

CONTENTS (Continued)

Document Number	Title

DRAWING (DWG) AND PARTS LIST (PL)

Note: The numerical sequence of the *PEI section is not continuous due to the fact that* processing documents not utilized on this program were not included.

PURPOSE

This report presents the results of the three year effort in satisfying the requirements of a Manufacturing Methods and Technology Program devoted to a representative range of surface acoustic wave (SAW) device designs.

The objective of this program was to establish a production capability for the purpose of meeting estimated military needs for a period of two years after the completion of the contract, and to establish a base and plans which may be used to meet expanded requirements. The manufacturing method emphasized the photolithographic fabrication of SAW devices that are reliable and reproducible at low cost.

Specific tasks included establishing and demonstrating a capability to manufacture the six SAW device designs on a pilot line basis using methods and processes suitable for a production rate of 150 devices per month for each type. In addition, engineering analysis and planning remains to be accomplished for expansion of the manufacturing capability which could accommodate the production of such devices at a rate of 500 each per month. This analysis and planning will be delivered in the General Report.

The program was divided into four phases. The first (Phase I First Engineering Sample) addressed the design, fabrication and analytical testing of six prototype SAW devices that are representative of the major current and potential application of the technology. While these device requirements did not represent the state-of-the-art in an R & D sense, they were of such complexity as to require a serious design effort in each case.

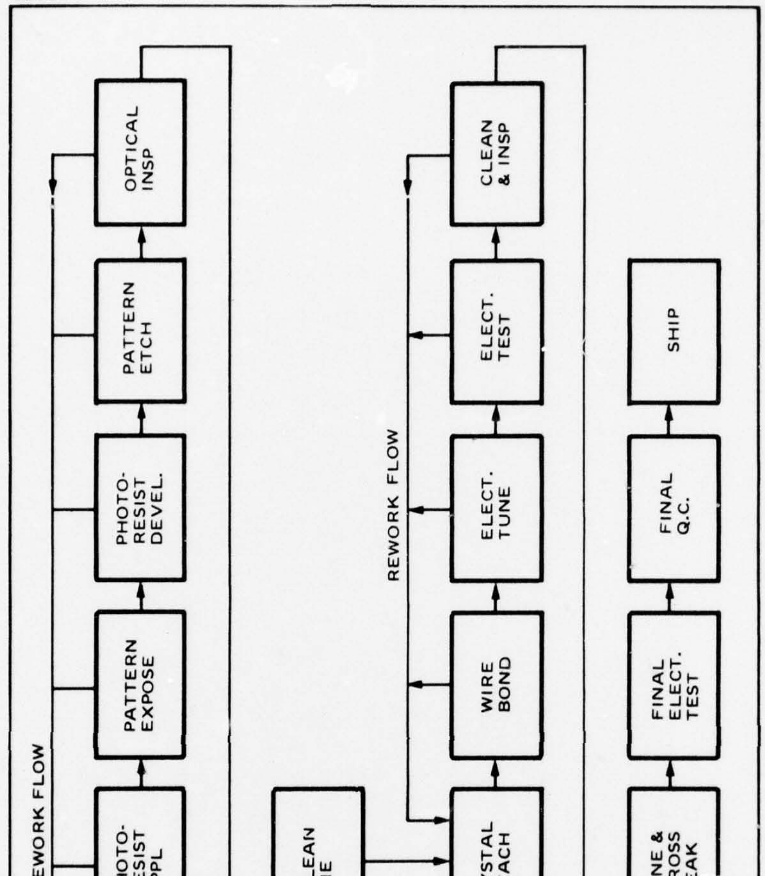
The second phase (Phase II – Second Engineering Samples) was performed to redesign those devices that failed the intended design specification. The net result of this effort was to be functional electrical specification adherence, based on a cost effective packaging commitment.

The third (Phase II – Confirmatory Samples) was to test and conform to specification for both the electrical and environmental commitment of the various devices. The final phase (Phase IV – Pilot Run) was to test the reproducibility of those predetermined electrical and environmental requirements in a high volume (500 per month) production environment. A key result of this phase was the establishment of meaningful manufacturing cost data on each device as well as a comparison of this data to the prior low volume efforts of the earlier phases. These data will then be extrapolated to a production rate of 500 per month with assumptions regarding facilities and equipment in the General Report.

GLOSSARY

SAW	-	Surface Acoustic Wave
BP-Q	-	Bandpass Filter - ST Quartz Substrate
BP-LN	-	Bandpass Filter - Lithium Niobate Substrate
TDL-100	-	Tapped Delay Line Filter - 100 MHz - ST Quartz Substrate
TDL-200	-	Tapped Delay Line - 200 MHz - ST Quartz Substrate
PC-Q	-	Pulse Compression Filter - ST Quartz Substrate
PE-Q	-	Pulse Expansion Filter - ST Quartz Substrate
PC-LN	-	Pulse Compression Filter - Lithium Niobate Substrate
PE-LN	-	Pulse Expansion Filter - Lithium Niobate Substrate
ST	-	Quartz orientation, ST cut (42^{o} 45'), X propagating
YZ	-	Lithium Niobate orientation, Y cut Z propagating
TIG	-	Tungsten Inert Gas Welding
MSC	-	Multistrip Coupler
K^2	-	Electromechanical Coupling Constant
f_o	-	Center frequency
B	-	Bandwidth
T	-	Time Delay
TXB	-	Time Bandwidth Product
VSWR	-	Voltage Standing Wave Ratio
DUT	-	Device Under Test
L_{INS}	-	Insertion Loss
$S_{S.L.}$	-	Sidelobe Suppression
$S_{f.t.}$	-	Feedthrough Suppression
S_{Spur}	-	Spurious Suppression
TTS	-	Triple Transit Signal

PROCESS ENGINEERING INSTRUCTIONS (PEI)



SAW Device Process Flow

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MICROELECTRONICS

instruction

Subject	Page 1 of 3	Number 7.18.01
ACOUSTIC SURFACE WAVE DEVICE PROCESS CRYSTAL INSPECTION	Date 19 December 1973	Revision A
	Approved William F. Case Jr	

1.0 SCOPE

This instruction covers the inspection of a crystal to assure a surface suitable for fabrication of acceptable acoustic surface wave devices.

2.0 EQUIPMENT AND MATERIAL

2.1 Equipment.

2.1.1 Microscope, Reichert Zetopan, with XY stage, incident oblique lighting and approximately 55X capability.

2.1.2 Log or record book.

2.2 Material.

2.2.1 Crystal substrate, of the material required, cut and polished, and marked with individual identification.

2.2.2 Finger cots.

3.0 GENERAL REQUIREMENTS

3.1 There shall be no scratches or pits with a depth greater than one-half micron. There shall be no residual patterns, or other defects in the surface area visible at 50X magnification.

3.2 There shall be no chips into the crystal edges which extend to within 1 milimeter of the active part of the device.

3.3 Any questionable imperfections will be brought to the attention of the process engineer or supervisor.

4.0 PROCEDURE

4.1 Start-up.

Not applicable.

4.2 Process instructions.

4.2.1 Place finger cots on all fingers which may touch the crystal.

Subject

ACOUSTIC SURFACE WAVE DEVICE PROCESS CRYSTAL INSPECTION

4.2.2 Record the crystal identification in the log book that is maintained in the Acoustic Laboratory.

4.2.3 Set up the optics of the microscope for approximately 55X magnification.

4.2.4 Carefully lift the crystal from it's carrier container and position it on the stage of the microscope with the surface to receive the processing on top.

4.2.5 Locate the incident light so that it illuminates the crystal surface under the microscope at a 45° angle maximum from the horizontal.

4.2.6 Slowly scan the crystal surface taking care to maintain good focus.

4.2.7 Note all imperfections in the log. Items to be noted are the following:

4.2.7.1 Scratches.

4.2.7.2 Pits.

4.2.7.3 Residual pattern from previous processing.

4.2.7.4 Edge defects.

4.2.7.5 Other irregularities.

4.2.8 If there is a residual pattern from previous processing which may be removed by etching, clean up the crystal per PEI 7.18.07. Then reinspect per this instruction.

4.2.9 If the surface condition is uncertain due to dirt or contamination, clean the crystal per PEI 7.18.02. Then reinspect per this instruction.

4.2.10 If during the inspection a condition is found which would prevent obtaining a good acoustic surface wave device, further inspection may be discontinued and the crystal returned for rework.

4.2.11 An entry will be noted in the log as to whether the crystal is acceptable for processing or to be returned for rework.

4.2.12 When the scanning is completed, the illumination will be relocated so as to originate from a direction 45° from the original direction, and the crystal shall be rescanned per 4.2.6 through 4.2.11 above.

Subject

ACOUSTIC SURFACE WAVE DEVICE PROCESS CRYSTAL INSPECTION

4.2.13 A crystal which has been deemed suitable for making an acceptable device will be forwarded to the next operation, or properly stored to await its use. In the latter case, a label shall be attached to its container noting that it has been inspected.

4.3 Shut-down.

Not applicable.

5.0 REFERENCES

Not applicable.

HUGHES AIRCRAFT COMPANY GROUND SYSTEMS GROUP

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PROCESS ENGINEERING INSTRUCTION
MICROELECTRONICS

instruction

Subject	Page 1 of 3	Number 7.18.02
ACOUSTIC SURFACE WAVE DEVICE PROCESS CRYSTAL SURFACE CLEANING	Date 19 December 1973	Revision A
	Approved William F. Carr Jr	

1.0 SCOPE

1.1 This instruction covers the cleaning of a crystal surface to obtain a surface suitable for obtaining satisfactory adhesion to photoresist and vacuum deposited metal films.

2.0 EQUIPMENT AND MATERIAL REQUIRED

2.1 Equipment.

2.1.1 Laminar flow work station with fume removal.

2.1.2 Oven, vacuum, 200°C and Nitrogen gas purge capability, capable of operation at 25 inches of mercury.

2.1.3 Resistivity meter, Balsbaugh Model 900, or equivalent.

2.2 Material.

2.2.1 Crystal, cut and polished, and inspected per PEI 7.18.01.

2.2.2 Deionized water, 12 - 18 megohm-cm resistivity and 0.45 micron filtered.

2.2.3 Nitrogen gas, dry, 0.45 micron filtered.

2.2.4 150 mm Petri Dish.

2.2.5 Polyfoam-tipped swabs.

2.2.6 Finger cots.

2.2.7 Rubber-tipped tweezers.

2.2.8 Alconox detergent powder.

3.0 GENERAL REQUIREMENTS

3.1 The cleaned crystal, immediately after cleaning and rinsing and prior to drying, must pass the "water-break" test described in 4.2.8.

3.2 The cleaned crystal must not be touched with bare fingers or be allowed to leave the clean laminar flow work station environment without adequate protection.

3.3 The total time elapsed between removal from the cooled vacuum-nitrogen oven and initiation of the next process (photoresist or metallization) shall be held to a minimum and shall in no case exceed one-half hour. If this time is exceeded, the crystal shall be recleaned starting with 4.2.7.

4.0 PROCEDURE

4.1 Start-up.

4.1.1 Verify D.I. water resistivity with resistivity meter and the flow of the deionized water.

4.1.2 Verify the condition of the final nitrogen gas filter at least weekly.

4.1.3 Adjust the oven temperature to 160° ± 2°C.

4.1.4 Verify adequacy of nitrogen gas supply.

4.1.5 Verify that the vacuum to the oven is operational and level is adequate. Set vacuum to 20 ± 4 inches of mercury.

4.2 Process Instructions.

4.2.1 Start deionized water flowing.

4.2.2 Cover at least the thumb and first two fingers of each hand with finger cots.

4.2.3 Place about 50 ml of Alconox into the 150 mm petri dish.

4.2.4 Carefully place the crystal to be cleaned into the petri dish.

4.2.5 Moisten a polyfoam swab with deionized water and dip it into the Alconox.

4.2.6 Hold the crystal against a flat surface with one hand while executing a light scrubbing motion across its surface using the swab in the other hand.

4.2.7 Lift the crystal and hold it under the running deionized water so that it flows from one end, across the entire crystal, and leaves at the other end. Allow the water to flow across the crystal for not less than one minute.

Subject

ACOUSTIC SURFACE WAVE DEVICE PROCESS CRYSTAL SURFACE CLEANING

4.2.8 Criterion: After removal in a horizontal position from the flow of water, orient the crystal so that the surface supports a volume of water sufficient to distribute itself over the entire crystal. When there is NO interruption in the uniform distribution of this water film it may be assumed that the crystal surface is practically clean for the acceptance of continued processing (i.e., photoresist and metallization).

4.2.9 If the above "water-break" test fails, return to step 4.2.6 and repeat the remaining cleaning steps.

4.2.10 When the crystal surface satisfies the "water-break" test, blow it dry with filtered dry nitrogen gas and place it in a clean dry petri dish.

4.2.11 Without leaving the protection of the laminar flow hood place the uncovered petri dish containing the crystal into the vacuum/nitrogen gas oven for an overnight bake @ 160°C ± 5°C. A sufficient volume of nitrogen gas is "leaked" into the oven to give a partial pressure of 20 inches ± 4 inches of Hg during the bake.

4.2.12 At the end of the bake period, the oven is shut off and allowed to cool to room temperature, while maintaining the vacuum and nitrogen flow.

4.2.13 The crystal must be forwarded immediately to the next process step.

4.3 Shut-down.

4.3.1 Turn off D.I. water flow.

5.0 REFERENCES

Not applicable

1.0 SCOPE

This process covers the application of photoresist images on metallized or unmetallized single crystal substrates for acoustic surface wave devices.

2.0 EQUIPMENT AND MATERIAL REQUIRED

2.1 Equipment.

2.1.1 Aligner and holder (HAC design).

2.1.2 Microscope, 7X to 40X zoom with vertical lighting.

2.1.3 U.V. exposure box (HAC design).

2.1.4 Photo resist dipper (HAC design).

2.1.5 Spray gun.

2.1.6 Laminar flow work stations.

2.1.7 Oven (set at 85°C).

2.1.8 Laminar flow work station with fume removal.

2.1.9 Resistivity meter, Balsbaugh Model 900, or equivalent.

2.2 Material.

2.2.1 Crystal, processed per PEI 7.18.02, crystal surface cleaning. If the etch process is to be used, the crystal shall also have been processed per PEI 7.18.04, vacuum deposition.

2.2.2 Finger cots.

2.2.3 Dry nitrogen gas 0.45 micron filtered.

2.2.4 Deionized water, 12 - 18 megohm resistivity, 0.45 micron filtered.

2.2.5 Photo resist, Shipley or equivalent.

2.2.6 Photo resist developer, Shipley or equivalent.

3.0 GENERAL REQUIREMENTS

3.1 The photo resist pattern shall conform to the following.

3.1.1 It shall be completely developed.

3.1.2 It shall have no defects that are not also in the photomask.

3.1.3 There shall be no contaminants which will interfere with the formation or delineation of the metal pattern.

3.1.4 The photo resist pattern shall be positioned and aligned on the crystal surface as required.

4.0 PROCEDURE

4.1 Start-up.

4.1.1 Make certain the photo resist dipper reservoir is full.

4.1.2 Verify that the oven temperature is 85°C ± 5°C.

4.1.3 The crystal clamp should be raised to allow clamping the crystal.

4.1.4 Set motor control to "lower" and speed control to "6".

4.1.5 Prepare the photo resist developer.

4.1.6 Verify D.I. water resistivity with resistivity meter.

4.2 Process Instructions.

4.2.1 Attach the crystal at one of its ends to the support wire by means of the clamp of the photo resist dipper.

4.2.2 Remove the cover from the photo resist reservoir.

4.2.3 Set motor control speed at "6" and lower crystal into photo resist solution so that all of the crystal is immersed except that portion held by the clamp.

4.2.4 Set motor control mode on "raise" and motor control speed on 2-1/2 (approximately 1 inch per minute).

4.2.5 Turn on motor control to initiate withdrawal.

CAUTION: Prior to and during the withdrawal, care must be exercised to prevent any vibrations to the coating equipment.

Subject

ACOUSTIC SURFACE WAVE DEVICE PROCESS PHOTO RESIST PROCESS

4.2.6 When the crystal has emerged entirely from the photo resist solution the motor control is switched off and the cover immediately placed over the photo resist solution.

4.2.7 Allow the crystal to air dry 5 minutes minimum.

4.2.8 Remove the crystal from the photo resist dipping apparatus and place in 85°C oven for 6 minutes ± 30 seconds.

4.2.9 Remove the crystal from the oven and allow it to cool to room temperature.

4.2.10 Position crystal and mask into aligner-holder.

4.2.11 Position crystal, mask, and aligner-holder beneath ultra violet lamp and expose for the required time.

4.2.12 Remove crystal from aligner-holder and spray develop for approximately 1 minute.

4.2.13 Spray rinse in deionized water (ambient temperature).

4.2.14 Blow dry with filtered dry nitrogen.

4.2.15 Inspect for acceptable photo resist pattern.

4.2.16 Postbake.

4.2.16.1 If the etch process is to follow, postbake at 85°C for 10 minutes ± 1 minute.

4.2.16.2 If the lift-off process is to be used, do not postbake.

4.2.16.3 Postbake may be done prior to the inspection step (4.2.15).

4.3 Shut-down.

Not applicable.

5.0 <u>REFERENCES</u>

Not applicable.

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instruction

Subject	Page 1 of 4	Number 7.18.04
ACOUSTIC SURFACE WAVE DEVICE PROCESS VACUUM DEPOSITION	Date 19 December 1973	Revision A
	Approved William F. Carr, Jr.	

1.0 SCOPE

This procedure provides a thin film of metallization to be deposited on the crystal surface to satisfy device requirements.

2.0 EQUIPMENT AND MATERIALS REQUIRED

2.1 Equipment.

2.1.1 Vacuum evaporation system, capable of 5×10^{-6} torr., minimum, vacuum.

2.1.2 Electron gun (E-gun), Airco Temescal, or an alternate energy source, to evaporate source metal.

2.1.3 Necessary tooling to support crystals during evaporation.

2.1.4 Sloan thickness monitor.

2.2 Material.

2.2.1 Crystal, cut and polished, of the material specified, cleaned per PEI 7.18.02. If the "lift-off" process is to be used, photoresist coat per PEI 7.18.03.

2.2.2 Finger cots.

2.2.3 Argon gas.

2.2.4 Liquid nitrogen.

2.2.5 Source material, as required.

3.0 REQUIREMENTS

3.1 Metal film shall be of the thickness required. Thickness shall be determined by use of the Sloan thickness monitor.

3.2 The metal film must be bright (reflective and specular), and not matte or cloudy in appearance.

3.3 The metal film must be free of pinholes when viewed at 350X.

Subject

ACOUSTIC SURFACE WAVE DEVICE PROCESS VACUUM DEPOSITION

3.4 The monitor slide shall pass the "tape test" for metal adhesion.

3.5 The monitor slide shall be etched for metalization thickness check.

4.0 PROCEDURE

4.1 Start-up.

4.1.1 Select proper scale on the Sloan thickness monitor and zero the instrument.

4.1.2 The vacuum system cleanliness should comply with Class 10,000 of FED-STD-209.

4.1.3 Use 5 grams of source material to perform the deposition.

4.2 Process Instructions.

4.2.1 Caution: The parts or materials to be placed into the vacuum evaporation system and the internal surfaces of the vacuum evaporation system must never be touched by bare hands or fingers. Always wear clean finger cots or appropriate gloves.

4.2.2 Close the high vacuum valve.

4.2.3 Fill the bell jar chamber with argon gas to ambient pressure.

4.2.4 Raise bell jar.

4.2.5 Remove tooling from top of chamber that will support crystals during evaporation.

4.2.6 Load crystals onto holders so that the surface to be patterned to will "see" the evaporant material. Blow off crystals with argon or nitrogen gas. Return holders to position in vacuum system.

4.2.7 Observe evaporant material to make certain there is a sufficient volume to perform the evaporation.

4.2.8 Lower bell jar.

4.2.9 Close foreline valve.

4.2.10 Open roughing valve.

4.2.11 Press "ON" power button to control console.

4.2.12 Admit liquid nitrogen to cold trap until full.

Subject

ACOUSTIC SURFACE WAVE DEVICE PROCESS VACUUM DEPOSITION

4.2.13 When bell jar chamber pressure is reduced to 50 $\pm$ 5 torr, close the roughing valve and open foreline valve.

4.2.14 Open high vacuum valve.

4.2.15 Turn on Ion gage and degas for approximately 1 minute.

4.2.16 Make sure high voltage button is OFF, then turn ON E-gun.

4.2.17 Rotate E-gun power control rheostat to minimum (counter-clockwise).

4.2.18 When pressure reaches 5×10^{-6} torr, proceed to 4.2.19.

4.2.19 After power warmup, push "ON" E-gun high voltage button.

4.2.20 Set E-gun power meter to indicate 100 ma for prebake.

4.2.21 Set Sloan meter at frequency relative to desired thickness.

4.2.22 Make sure shutter is between the evaporant source and crystals.

4.2.23 Increase E-gun power setting to 300 ma.

4.2.24 After 5-7 seconds, open shutter to expose crystal to evaporant material.

4.2.25 When desired deposition thickness is achieved (as indicated by the Sloan meter), close shutter.

4.2.26 Reduce E-gun power control to its minimum position and push switch to off position. Shut off Sloan meter.

4.2.27 Shut off Ion gage.

4.2.28 Switch therm[illegible]le gage to foreline sensor.

4.2.29 Close high vacuum valve.

4.2.30 Cool chamber tooling to less than 100°C and then backfill with argon gas.

4.2.31 Raise bell jar.

4.2.32 If tooling is cool enough, the crystal holders may be removed.

4.2.33 With extreme care, the crystals are placed into their protective containers.

4.3 Shut-down.

4.3.1 Lower bell jar.

4.3.2 Close foreline valve

4.3.3 Open roughing valve.

4.3.4 Switch thermocouple gage from foreline sensor to bell jar chamber sensor.

4.3.5 Allow pressure to reach 50 $\pm$ 5 torr, and close roughing valve.

4.3.6 Open foreline valve.

4.3.7 Return thermocouple gage to foreline sensor.

4.3.8 Shut off main power on console

5.0 REFERENCES

5.1 Government Standards and Specifications

Federal Standards

FED-STD-209	Clean Room and Work Station Requirements, Controlled Environment.

5.2 Internal Specifications and Instructions.

Not applicable.

HUGHES AIRCRAFT COMPANY GROUND SYSTEMS GROUP

ENGINEERING DIVISION
PROCESS ENGINEERING INSTRUCTIONS
MICROELECTRONICS

instruction

Subject	Page 1 of 3	Number 7.18.06
ACOUSTIC SURFACE WAVE DEVICE PROCESS ETCH PROCESS	Date 19 December 1973	Revision A
	Approved William F. Carr, Jr	

1.0 SCOPE

This procedure provides for the formation and definition of the metal pattern through the utilization of etch solution.

2.0 EQUIPMENT AND MATERIAL REQUIRED

2.1 Equipment.

2.1.1 Container, Etch.

2.1.2 Microscopes, stereozoom and Reichert Zetopan, or equivalent.

2.1.3 Petri dish (dimensions depend on crystal size).

2.1.4 Tweezers

2.1.5 Resistivity meter, Balsbaugh Model 900, or equivalent.

2.1.6 Hot plate with magnetic stirrer.

2.2 Material.

2.2.1 Crystal, with the required processes having been performed (PEI 7.18.01, PEI 7.18.02, PEI 7.18.03 and PEI 7.18.04).

2.2.2 Aluminum etchant per 4.1.4.

2.2.3 Deionized water, 12-18 megohm--cm resistivity, 0.45 micron filtered.

2.2.4 Dry nitrogen, 0.45 micron filtered.

2.2.5 Phosphoric acid, electronic grade, Baker and Adamson or equivalent.

2.2.6 Nitric acid, electronic grade, Baker and Adamson or equivalent.

2.2.7 Acetone, electronic grade, Baker and Adamson or equivalent.

3.0 GENERAL REQUIREMENTS

The completed pattern of aluminum on the crystal shall meet the following:

Subject

ACOUSTIC SURFACE WAVE DEVICE PROCESS ETCH PROCESS

3.1 Metallization must be attached to crystal throughout entire pattern (no lifting).

3.2 Any observable shorts or discontinuities shall be brought to the attention of the supervisor or responsible engineer.

3.3 If additional cleaning is required clean per PEI 4.18.07.

4.0 PROCEDURE

4.1 Start-up.

4.1.1 Verify D.I. water resistivity with resistivity meter.

4.1.2 Aluminum etchant Preparation. Into 180ml ±5ml of deionized water add 800ml ±5ml of phosphoric acid and 40ml ±2ml of nitric acid. Mix thoroughly. Store in a clean, capped polyethylene bottle.

4.1.3 Initiate a flow of deionized water in the sink.

4.1.4 Pour a sufficient volume of aluminum etchant into the etch container to cover crystal. Do not treat more than 150 square inches of metalized crystal surface in each 200ml of solution.

4.2 Process Instructions

4.2.1 Hold crystal by edges with tweezers and immerse into aluminum etchant solution.

4.2.2 Gently agitate the dish to insure that the crystal "sees" fresh etchant uniformly for 2 to 3 minutes.

4.2.3 Remove crystal from alumium etchant and rinse with running deionized water.

4.2.4 Observe metallization to see if additional etching is required.

4.2.5 If additional etching is necessary, usually 30 secs is sufficient, return to 4.2.1 and go to 4.2.4.

NOTE: If the etching is not proceeding satisfactorily, it may be necessary to warm the etchant about 5°C or prepare fresh etchant.

4.2.6 Rinse crystal in deionized water.

4.2.7 Blow dry with filtered dry nitrogen.

4.2.8 Inspect the crystal with the aid of a microscope (zoom or Reichert, as required).

4.2.9 Strip the photo resist by immersing the crystal in acetone for approximately three minutes.

4.2.10 Rinse the crystal with a stream of fresh acetone from a squirt bottle.

4.2.11 Blow dry with filtered nitrogen.

4.2.12 Inspect under a microscope for completeness of photo resist removal.

4.3 Shut-down.

Not applicable.

5.0 REFERENCES

Not applicable.

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instruction

Subject	Page 1 of 2	Number 7.18.07
ACOUSTIC SURFACE WAVE DEVICE PROCESS CLEAN-UP PROCESS	Date 19 December 1973	Revision A
	Approved William F. Carr, Jr	

1.0 SCOPE

The following procedure is performed to insure that there will be no residual metallization extraneous to the desired pattern.

2.0 EQUIPMENT AND MATERIAL REQUIRED

2.1 Equipment.

2.1.1 Microscope, 7X - 40X zoom.

2.2 Material.

2.2.1 Crystal, with metal pattern etched on its surface as per PEI 7.18.06 etch process.

2.2.2 Wooden sticks (i.e., polyfoam swabs).

2.2.3 50 or 100 ml beaker.

2.2.4 Aluminum etchant.

3.0 GENERAL REQUIREMENTS

3.1 The crystal must be free of all extraneous metallization either within the pattern or outside of it on the top surface of the crystal.

3.2 The completed crystal with metal pattern must comply with the general requirements of PEI 7.18.06.

4.0 PROCEDURE

4.1 Start-up.

4.1.1 Pour small volume of aluminum etchant into 50 or 100 ml beaker.

4.1.2 Sharpen polyfoam swab sticks to sharp point.

4.2 Process instructions.

4.2.1 Carefully place crystal on the microscope stage, focus for maximum clarity and scan for extraneous metallization.

4.2.2 When an area is discovered that requires additional cleaning, dip the wooden stick into the aluminum etchant and bring the saturated point gently to the material to be eliminated.

NOTE: If an area in need of clean-up is part of or adjacent to pattern, use the stick to deliver the etchant but do not physically make contact between stick and metallization.

4.2.3 Move the stick so as to agitate the etchant over the area to be eliminated.

4.2.4 When the undersireable metal has been removed place the crystal in the flow of running deionized water.

4.2.5 Remove the crystal from the running water and rinse with isopropyl alcohol.

4.2.6 Blow dry with dry filtered nitrogen.

4.2.7 Repeat steps 4.2.2 through 4.2.6 until all undersireable metal is removed from the crystal.

4.3 Shut-down.

Not applicable.

5.0 <u>REFERENCES</u>

Not applicable.

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instruction

Subject ACOUSTIC SURFACE WAVE DEVICE FINAL IN-PROCESS INSPECTION	Page 1 of 2 Date 19 December 1973 Approved William F. Carr, Jr.	Number 7.18.08 Revision A

1.0 SCOPE

This instruction provides assurance that device quality is as required.

2.0 EQUIPMENT AND MATERIAL REQUIRED

2.1 Equipment.

2.1.1 Reichert Zetopan microscope, or equivalent, with XY stage, incident lighting, and 55X, 110X, 220X magnification capability.

2.2 Material.

2.2.1 Crystal processed according to PEI 7.18.05, PEI 7.18.06 and PEI 7.18.07 as applicable.

2.2.2 Finger Cots.

2.2.3 Tweezers.

2.2.4 Process follower sheet.

3.0 GENERAL REQUIREMENTS

3.1 There shall be no opens or shorts in the electrode fingers beyond that allowed for the particular device.

3.2 There must not be any contamination such as photoresist, finger prints or dirt etc.

3.3 The pattern shall be parallel with the long axis of the crystal to the extent it can be determined with the unaided eye.

3.4 The pattern shall be centered between the ends of the crystal, unless otherwise indicated by the engineering drawing.

4.0 PROCEDURE

4.1 Start-up.

4.1.1 Place finger cots on those fingers that may touch the crystal.

4.1.2 Select the microscope objective that will offer the desirable magnification and insert it into the microscope.

Subject

ACOUSTIC SURFACE WAVE DEVICE FINAL IN-PROCESS INSPECTION

4.1.3 Switch on the microscope illuminator.

4.1.4 Rotate the stage control knob so as to bring the stage forward towards the observer.

4.1.5 Cautiously position the crystal on the stage so that the surface with the pattern is up and focus for maximum clarity.

4.2 Process Instructions.

4.2.1 Scan the entire surface of the crystal making observations as outlined in section 3.0, Process Requirements, and noting same on the process follower sheet.

4.2.2 If there is any metal extraneous to the pattern reprocess the crystal per PEI 7.18.07.

4.2.3 All irregularities, either defined by section 3.0 or not, must be brought to the attention of the supervisor or responsible engineer.

4.2.4 Disposition.

4.2.4.1 Acceptable devices shall be forwarded to the next process step.

4.2.4.2 Unacceptable devices will be dispositioned per the instructions of the supervisor or process engineer.

4.3 Shut-down.

Not applicable.

5.0 REFERENCES

Not applicable.

HUGHES HUGHES AIRCRAFT COMPANY GROUND SYSTEMS GROUP	ENGINEERING DIVISION PROCESS ENGINEERING INSTRUCTION MICROELECTRONICS **instruction**	
Subject SURFACE ACOUSTIC WAVE (SAW) SUBSTRATE CLEANING	**Page** 1 **of** 3 **Issue** 2-13-78	**Number** 7.18.14 **Revision** —
	Approved [signature]	**Date** 2-3-78
	Approved [signature]	**Date** 2-3-78

1.0 SCOPE

1.1 This instruction covers surface acoustic wave (SAW) substrate cleaning.

2.0 EQUIPMENT AND MATERIAL REQUIRED

2.1 Equipment.

2.1.1 Sink with D.I. water, 14 meg ohm resistivity or greater.

2.1.2 Beakers, size as required.

2.1.3 Tweezers, size 5 or equavalent.

2.1.4 Substrate carrier.

2.1.5 N_2 blow gun.

2.1.6 Wash bottle.

2.1.7 Petri dishes.

2.1.8 Swabs (foam, cotton).

2.1.9 Spinner (optional).

2.1.10 Measuring flask, 100 ml or equivalent.

2.2 Material.

2.2.1 Chromium oxide (CrO_3) reagent grade or equivalent.

2.2.2 Sulfuric acid (H_2SO_4) reagent grade or equivalent.

2.2.3 Detergent (Turco Sudz or equivalent).

2.2.4 Acetone, reagent grade or equivalent.

2.2.5 Dry Nitrogen; 99.9% Purity

2.2.6 Isopropanol, reagent grade or equivalent.

3.0 GENERAL REQUIREMENTS OR INSTRUCTIONS

3.1 When cleaned using these processes substrate should exhibit no evidence of undesirable foreign material or contamination when viewed at 30X magnification.

3.2 If the substrates are to be subjected to thin film deposition as the next step in device processing then evidence of adequate cleaning will be a successful adhesion test.

4.0 PROCEDURE

4.1 As received, SAW substrates can be cleaned using individual or a combination of the following procedures:

4.1.1 Detergent cleaning.

4.1.1.1 Prepare detergent solution by pouring one part of Turco Sudz to 20 parts D.I. water.

4.1.1.2 Hold substrate with tweezers or by other suitable means.

4.1.1.3 Scrub wafer with a diluted detergent solution using a foam swab.

4.1.1.4 Rinse wafer in D.I. water a minimum of 5 seconds making sure to also rinse the tweezers and the area under the tweezers.

4.1.1.5 Blow dry with N_2 using spinner if appropriate. N_2 should be directed toward top of substrate while the back of the substrate may be blotted dry.

4.1.2 Solvent cleaning. Cognizant engineer will specify solvent.

4.1.2.1 Immerse substrate in solvent briefly or until visibly clear of such foreign material as photoresist. Scrub if necessary with foam or cotton swab.

4.1.2.2 Remove from solvent while rinsing part with wash bottle of same solvent (do not let part dry) and transfer to water rinse.

4.1.2.3 Proceed as in 4.1.1.4 through 4.1.1.5.

4.1.3 Acid cleaning.

4.1.3.1 Prepare chromic acid:

4.1.3.1.1 Pour 10 ±1 grams of chromium oxide (CrO_3) into a 1,000 ml beaker. Add 10 ml of D.I. water. Stir solution until all chromium oxide is dissolved. Add 600 ml ±200 ml of sulphuric acid and stir carefully.

4.1.3.2 Slowly immerse parts into chromic acid using a suitable holder (Teflon or other material inert to the acid) and leave in acid from 5 to 20 minutes or as necessary to remove residue.

4.1.3.3 Rinse parts by slowly immersing in running D.I. water.

4.1.3.4 Proceed as in 4.1.1.2 through 4.1.1.5.

5.0 REFERENCE

5.1 Government standards and specifications.

5.1.1 Not applicable.

5.2 Internal specifications.

5.2.1 Not applicable.

HUGHES HUGHES AIRCRAFT COMPANY GROUND SYSTEMS GROUP	ENGINEERING DIVISION PROCESS ENGINEERING INSTRUCTION MICROELECTRONICS **instruction**	
Subject VACUUM SYSTEM OPERATION	Page 1 of 3 Issue 2-13-78 Approved J Santana Approved D J Davis	Number 7.18.15 Revision – Date 2-2-78 Date 2-3-78

1.0 SCOPE

1.1 This instruction covers the operating procedure for obtaining a vacuum of 10^{-5} torr or better using a conventional diffusion pumped vacuum system.

2.0 EQUIPMENT AND MATERIALS REQUIRED

2.1 Equipment.

2.1.1 Vacuum system - Vecco - VE-400 or similar.

2.1.2 High voltage power supply.

2.2 Materials.

2.2.1 Industrial water.

2.2.2 Argon, 99.999 percent pure.

2.2.3 Nitrogen gas, 99.9% pure

2.2.4 Liquid Nitrogen.

3.0 GENERAL REQUIREMENTS OR INSTRUCTIONS

3.1 The bell jar should always be down and system under vacuum except when loading or unloading.

4.0 PROCEDURE

4.1 Startup.

4.1.1 Open the water valve behind the vacuum system to turn on the cooling water for the diffusion pump and the E-gun.

4.1.2 Close the roughing, foreline, gate and vent valves. They are located on the front panel. These valves are normally closed at this time. Notify the supervisor if any were found to be open. Turn the valves clock wise to close.

4.1.3 Turn on the roughing and diffusion pumps using the marked electrical switches.

VACUUM SYSTEM OPERATION

4.1.4 After 3^{+2}_{-0} minutes, open the foreline valve, by turning the valve counter clock wise.

4.2 Process instructions.

4.2.1 Rotating counter clockwise open vent valve until backfill is complete. Then close.

4.2.2 Raise belljar by pressing belljar raise button.

4.2.3 Perform substrate loading functions.

4.2.4 Lower belljar, by pressing belljar and safety switches. Close foreline valve by turning it clockwise.

4.2.5 Slowly open roughing valve by turning it counterclockwise.

4.2.6 When the pressure drops to 100 μM or less open argon (Ar) bleed valve (toggle) and stabilize pressure at around 100 μm (with micrometer valve).

4.2.7 Turn on high voltage supply and increase voltage to initiate a glow discharge and until a current of 400 ma is indicated. Maintain the glow discharge from 5 to 20 minutes then turn off H.V. supply.

4.2.8 Close Argon bleed valve (toggle).

4.2.9 Fill cold trap with liquid N_2.

4.2.10 With pressure below 100 μm, close roughing valve, open foreline valve and slowly open the gate valve.

4.2.11 With pressure indicating less than 20 μm, turn on ionization guage (10^{-4} range).

4.2.12 When ionization guage indicates 1×10^{-5} or less as required, proceed with deposition as described in separate PEI 7.18.16.

4.2.13 Turn off ionization guage.

4.2.14 Close gate valve.

4.2.15 Open (slowly) vent valve until backfill is complete. Then close.

4.2.16 Raise belljar.

4.2.17 Unload chamber.

VACUUM SYSTEM OPERATION

4.2.18 Lower belljar.

4.2.19 Perform 4.2.5.

4.2.20 When roughing pressure drops to 100 µm close the roughing valve.

4.2.21 Open foreline valve.

4.3 Shutdown.

4.3.1 With foreline valve open and all others closed, turn off diffusion pump.

4.3.2 After 1/2-hour close foreline valve and turn off mechanical pump.

5.0 <u>REFERENCE</u>

5.1 Government standard and specification.

5.1.1 Not applicable.

5.1 Internal specifications and instructions.

5.2.1 PEI 7.18.16 - Then Film E-Beam Evaporation.

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instruction

Subject	Page 1 of 2	Number 7.18.16
THIN FILM E-BEAM EVAPORATION	Issue 2-8-78	Revision —
	Approved	Date 2-8-78
	Approved	Date 2-8-78

1.0 SCOPE

1.1 This instruction covers thin film deposition using an electron beam evaporator.

2.0 EQUIPMENT AND MATERIAL REQUIRED

2.1 Equipment.

2.1.1 Vacuum system (VE-400 or similar).

2.1.2 High voltage power supply (CVC Mod. LC031 or similar).

2.1.3 Electron beam equipment (Airco Temescal - STIH 270-2M, gun and CV-8, power supply or similar).

2.1.4 Evaporation controller (Inficon XMS-3 or similar).

2.2 Material.

2.2.1 Source material as required.

3.0 GENERAL REQUIREMENTS OR INSTRUCTIONS

3.1 This process should yield thin evaporated films with a thickness, uniformity and adhesion necessary to fabricate thin film devices.

4.0 PROCESS INSTRUCTION

4.1 Startup.

4.1.1 Open the vacuum chamber, remove the holder plate and load the substrates on the plate, using button magnets to hold them in place. Carefully replace the holder plate into the chamber by inverting and sliding it onto the support structure.

4.1.2 Evacuate the chamber for evaporation as delineated in Steps 4.2.4 through 4.2.12 in PEI 7.18.15.

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4.2 Process instruction.

4.2.1 Turn on E-beam power supply (main power) and controller (key switch, H.V. on, gun #1 fil. on) assuring that all interlock lights are on.

4.2.2 Determine that evaporation controller is appropriately programmed according to the process being used and those listed in the evaporation log book.

4.2.3 Press start button on the controller.

4.2.4 Manually open shutter by rotating shutter knob C.W. when "thickness 1" lights.

4.2.5 Close shutter by reversing 4.2.4 when "thickness 2" light illuminates.

4.2.6 Turn off controller and supply.

4.2.7 Wait approximately 5 minutes to cool gun before opening chamber.

4.3 Shutdown.

4.3.1 To remove substrates, proceed with PEI 7.18.15 - Steps 4.2.13 through 4.2.17.

5.0 <u>REFERENCES</u>

5.1 Government standards and specifications.

5.1.1 Not applicable.

5.2 Internal specifications and instructions.

5.2.1 PEI 7.18.15 - Vacuum System Operation.

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instruction

Subject	Page 1 of 3	Number 7.18.17
PHOTORESIST APPLICATION (SPINNING)	Issue 2-13-78	Revision
	Approved	Date 2-2-78
	Approved	Date 2-3-78

1.0 SCOPE

1.1 This instruction covers the application of photoresist to a substrate by using the spinning technique.

2.0 EQUIPMENT AND MATERIALS REQUIRED

2.1 Equipment.

2.1.1 Photoresist spinner (Solid State Equipment Model 103 or equivalent).

2.1.2 N_2 blow gun.

2.1.3 Tweezers.

2.1.4 Oven capable of 125 C.

2.2 Materials.

2.2.1 Photoresist Shipley AZ1350B2 or AZ1350J or equivalent as specified by Process Engineer.

2.2.2 Vacuum 20" or better, house vacuum.

2.2.3 N_2, 99.9% purity.

2.2.4 Finger cots.

2.2.5 Acetone, reagent grade

3.0 GENERAL REQUIREMENTS

3.1 Thin uniform photoresist coatings are necessary for high resolution photolithography.

4.0 PROCEDURE

4.1 Startup.

4.1.1 Provide external facilities hookup to the photoresist spinner as required in the equipment instruction manual.

4.1.2 Turn on electrical power.

PHOTORESIST APPLICATION (SPINNING)

4.1.3 Rotate speed control fully CCW (minimum speed).

4.1.4 Fast/slow switch position in slow position unless otherwise instructed on flow sheet.

4.1.5 Place wafer chuck on spindle.

4.1.6 Set timer as required, approximately 20 seconds.

4.1.7 Place wafer on wafer chuck (centered).

4.1.8 Turn on vacuum switch. Vacuum gauge should indicate in excess of 12" and yellow "Low vacuum" light must extinguish.

4.1.9 Press start switch.

4.1.10 Rotate speed control CW until desired speed is indicated on gauge, approximately 5K RPM or per Cognizant Engineer's instructions.

4.1.11 When spinner stops, turn off vacuum and remove wafer.

4.2 Procedure.

4.2.1 Place wafer on chuck (centered).

4.2.2 Turn on vacuum and satisfy 4.1.8.

4.2.3 Blow possible foreign material from top of wafer with N_2 blow gun.

4.2.4 Apply adequate amount of photoresist to top of wafer with eyedropper or other suitable means.

4.2.5 Press start button.

4.2.6 When spinner stops, turn off vacuum and remove wafer.

4.2.7 Place coated wafers in an oven set to 95 ± 5°C for 20 minutes or as specified by the Cognizant Engineer.

4.3 Shutdown.

4.3.1 Turn off vacuum and electrical power.

4.3.2 Clean up using acetone to remove resist residue.

PHOTORESIST APPLICATION (SPINNING)

5.0 REFERENCES

5.1 Government standards and specifications.

5.1.1 Not applicable

5.2 Internal specifications and instructions.

5.2.1 Not applicable

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MATERIAL & PROCESSES

instruction

Subject		
PHOTORESIST EXPOSURE USING KASPAR 1800 ALIGNMENT/EXPOSURE EQUIPMENT	Page 1 of 4	Number 7.18.18
	Issue 10-10-78	Revision —
	Approved [signature]	Date 10/9/78
	Approved [signature]	Date 10/9/78

1.0 SCOPE

1.1 This instruction covers the exposure of a pattern on a photoresist coated substrate using an alignment/exposure machine equipped with a ultraviolet light source.

2.0 EQUIPMENT AND MATERIAL REQUIRED

2.1 Equipment.

2.1.1 Alignment/exposure machine (Kaspar 1800 or equialent).

2.1.2 Photo mask, as specified.

2.1.3 Filtered and dry pressurized nitrogen source.

2.1.4 Tweezers, 86BSA (Technitool or equivalent).

2.1.5 Petri dish and cover - 4 inch diameter.

2.1.6 Vacuum source, 21 inches of mercury, minimum.

2.2 Materials.

2.2.1 Wafer, as specified on the applicable drawing.

3.0 GENERAL REQUIREMENTS

3.1 The pattern exposed on the photoresist coated substrate shall exactly duplicate the pattern on the photo mask. Lines shall be sharp and clear.

4.0 PROCEDURE

4.1 Start-up.

4.1.1 Turn on power by depressing "Power" button located on the right side of the console (light illuminator).

4.1.2 Turn on the exposure light by depressing the "Power On" button located on the lamp control power supply to the left of the console (light illuminator).

PHOTORESIST EXPOSURE USING KASPAR 1800 ALIGNMENT/EXPOSURE EQUIPMENT

4.1.3 Depress and quickly release (approximately 1 second) the "Starter" button next to the power button on the lamp control power supply to illuminate the exposure light.

NOTE: Allow a minimum of 10 minutes warm up time of the exposure lamp prior to use.

4.1.4 Set the exposure time on the timer to that which is specified on the Standard Flow Sheet (SFS).

4.1.5 Verify that the turret is rotated to the "Split Field High Power" position.

4.1.6 Depress the "Load Mask" and the "Visual Align" buttons on the right side on the console to the left of the exposure head (lights will illuminate).

4.1.7 Lift the mask holder table, by hand, to the extreme back position and bring it forward slightly to the stop upright position.

4.1.8 Turn on the vacuum to the holder plate by turning the vacuum valve to the right of the console.

4.1.9 Locate the mask on the holder plate using the three alignment stops on the plate.

NOTE: Place the emulsion side of the mask toward the front and the mirrored chrome surface away from you.

CAUTION: With the mask holder setting just forward of the extreme back position, the vacuum will hold the mask securely in place. Pushing the mask holder to the extreme back position releases the vacuum to remove the mask.

4.2 Procedure.

4.2.1 With the mask holder plate in the up position, center the wafer on the chuck. Orient the wafer so that the cut corners are at the top and bottom of the right hand side.

4.2.2 Lower the mask holder.

4.2.3 Push the mask load button to secure the mask holder table in the down position. (The light will go out.)

4.2.4 Push the "Load Manual" button to raise the wafer chuck to contact the mask. (The light will illuminate and then go off.)

4.2.5 Visually determine the alignment of the wafer edge to the mask. If adjustment is necessary, push the "Mask Load" button. (The light will illuminate.) Raise the mask holder slightly and adjust the alignment by using the rotation adjustment, the alignment disk, and the rotary mask adjustment knobs.

4.2.6 When the mask and wafer are properly aligned, push the "Mask Load" button (light out) and the "Contact" button (light on).

4.2.7 Center the scanner disk on its pad.

4.2.8 Push the "Visual Alignment" button (light out) to lower the exposure head.

4.2.9 Set timer per instructions on flow sheet.

4.2.10 Turn the turret to the "Expose" position and wait for the exposure light to go off.

4.2.11 Return the turret to the "Split Field High Power" position.

4.2.12 Push the "Mask Load" and "Visual Align" buttons to raise the exposure head.

4.2.13 Raise the mask holder table, and using a pair of tweezers, remove the wafer to a petri dish and cover the wafer.

4.2.14 If another wafer is to be processed, repeat steps 4.2.1 through 4.2.13.

4.3 Shut-down.

4.3.1 Remove the mask by lifting the mask holder table to the extreme back position to cut off the vacuum. Lift the mask from the locating stops and lower the table.

4.3.2 Lower the exposure head by pushing the "Mask Load" and "Visual Align" buttons. (Lights off.)

4.3.3 Push the lower button (light off). Close the vacuum valve and turn off the exposure lamp by switching the power off.

PHOTORESIST EXPOSURE USING KASPAR 1800 ALIGNMENT/EXPOSURE EQUIPMENT

5.0 REFERENCES

5.1 Not applicable.

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instruction

Subject	Page 1 of 2	Number 7.18.19
PHOTORESIST DEVELOPMENT	Issue 2-7-78	Revision -
	Approved	Date 1-30-78
	Approved	Date 2-7-78

1.0 SCOPE

1.1 This instruction covers the use of certain developer materials and techniques necessary to produce high resolution images on exposed photoresist coated substrates.

2.0 EQUIPMENT AND MATERIALS REQUIRED

2.1 Equipment.

2.1.1 Petri dishes or other suitable container for chemical solutions.

2.1.2 Photoresist spinner; Solid State Equipment Model 103 or Equivalent.

2.1.3 N_2 Blow gun.

2.1.4 Sink.

2.2 Materials.

2.2.1 D. I. water, 14 meg ohm resistivity or greater.

2.2.2 Developer solution, Shipley AZ developer.

2.2.3 Tweezers, size 5 or equivalent.

2.2.4 Fingers cots.

2.2.5 Dry nitrogen.

3.0 GENERAL REQUIREMENTS

3.1 Once a sensitized photoresist coated substrate has been exposed it must be developed (selective removal of certain portions of this resist) yielding an image identical to the mask through which it was exposed.

4.0 PROCEDURE

4.1 Start up.

4.1.1 Prepare the developer by mixing 50 ml of AZ developer with 50 ml of D. I. water.

PHOTORESIST DEVELOPMENT

4.2 Procedure.

4.2.1 Immerse exposed substrate for a specified time (10 to 60 seconds) or until visual indication of complete development and remove.

4.2.2 Rinse under running D. I. water for a minimum of 5 seconds.

4.2.3 Proceed with etching process as described in PEI 7.18.20 Step 4.2.1 OR continue with 4.2.4 of this PEI.

4.2.4 After complete rinsing spin wafer dry or blow dry with N_2.

4.3 Shutdown.

4.3.1 Dispose of chemicals properly.

5.0 REFERENCES

5.1 Government standard and specifications.

5.1.1 Not applicable.

5.2 Internal specification and instructions.

5.2.1 PEI 7.18.20 - Thin Film Pattern Definition (Etch).

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Subject	Page 1 of 2	Number 7.18.20
THIN FILM PATTERN DEFINITION (ETCH)	Issue 2-8-78	Revision —
	Approved C Santiago	Date 2-2-78
	Approved DJ Oe	Date 2-3-78

1.0 SCOPE

1.1 This instruction describes the etch process by which a pattern that has been previously defined in photoesist coating is etched into an underlying thin film.

2.0 EQUIPMENT AND MATERIAL REQUIRED

2.1 Equipment.

2.1.1 Petri dishes or other suitable containers for chemical solutions.

2.1.2 Photoresist spinner, Solid State Equipment Model 103 or equivalent.

2.1.3 N_2 blow gun.

2.1.4 Sink

2.2 Material.

2.2.1 D. I. water, 14 meg ohm resistivity minimum.

2.2.2 Tweezers, style 5 or equivalent.

2.2.3 Dry nitrogen, 99.9% purity.

2.2.4 Nitric acid reagent grade.

2.2.5 Phosphoric acid reagent grade.

2.2.6 Acetic acid Reagent grade.

2.2.7 Finger cots.

3.0 GENERAL REQUIREMENTS

3.1 After a thin film coated substrate has had a photoresist pattern defined on it, the pattern must be etched into the thin film forming the actual circuit pattern in the thin film. This pattern should very closely approximate the mask geometry exhibiting no shorts or opens or variations in line to space ratios.

THIN FILM PATTERN DEFINITION (ETCH)

4.0 PROCEDURE

4.1 Startup.

4.1.1 Prepare the aluminum etchant by mixing 60 ml D.I. water, 1,600 ml phosphoric acid, 100 ml acetic acid and 100 ml nitric acid.

4.2 Process instructions.

4.2.1 Immerse substrate into etch. Remove when there is visual indication that etching is complete, such as when the field appears clear.

4.2.2 Rinse in running D. I. water for 2 minutes minimum.

4.2.3 After complete rinse, spin dry or blow dry with N_2.

4.2.4 Inspect and repeat 4.2.1 through 4.2.3, if necessary.

4.3 Shutdown.

4.3.1 Dispose of etchant.

4.3.2 Turn off D. I. water.

5.0 REFERENCES

5.1 Government standards and specifications.

5.1.1 Not applicable.

5.2 Internal specifications and instructions.

5.2.1 Not applicable

HUGHES HUGHES AIRCRAFT COMPANY GROUND SYSTEMS GROUP	ENGINEERING DIVISION PROCESS ENGINEERING INSTRUCTION MICROELECTRONICS **instruction**		
Subject SUBSTRATE DICING	Page 1 of 9	Number 7.18.22	
	Issue 11-2-78	Revision -	
	Approved T.E. [signature]	Date 10/30/78	
	Approved [signature]	Date 11/1/78	

1.0 SCOPE

1.1 This instruction describes the dicing of substrates into individual die.

2.0 EQUIPMENT AND MATERIAL REQUIRED

2.1 Equipment.

2.1.1 Dicing saw with accessory tools; Electroglass Model 106; or equivalent.

2.1.2 Hot plate, 100°-300°F temperature range.

2.1.3 Petri dishes, 4 to 5 inch diameter.

2.1.4 Vacuum system capable of maintaining 26 inches of mercury.

2.1.5 Photoresist spinner.

2.2 Materials.

2.2.1 Deionized water.

2.2.2 Dry nitrogen gas.

2.2.3 Optical mounting pitch; R. Howard Strausberg; or equivalent.

2.2.4 Double back tape; 3M; or equivalent.

2.2.5 Detergent; Dynatex KERF-AID; or equivalent.

2.2.6 Acetone; reagent grade or better.

2.2.7 Lubricant; KERF-AID 101, 102; or equivalent.

2.2.8 Photoresist; AZ1350J; or equivalent.

DICING

3.0 GENERAL REQUIREMENTS OR INSTRUCTIONS

3.1 Wafers with multiple circuit patterns are to be cut to yield individual die of single circuit patterns.

3.2 The operator shall receive a minimum of 4 hours training from Supervision or Process Engineering in the operation of this equipment and the operational process in accordance with this document.

3.3 If the machine malfunctions, notify the supervisor immediately.

4.0 PROCEDURE

4.1 Start-up

4.1.1 Saw blade replacement and installation.

4.1.1.1 The following tools (supplied with the dicing saw) are required to replace the saw blade.

1. Spindle Nut Wrench Part No. 106122
2. Blade Handler Part No. 106123
3. Blade Stand Part No. 106418
4. Guard Removal Tool Part No. 060952

4.1.1.2 Remove the two plastic covers from the front of the spindle housing.

4.1.1.3 Turn the nozzle retractor screw full clockwise to retract the nozzle away from the blade area.

4.1.1.4 Remove the spindle nut with the Spindle Nut Wrench. Hold the exterior knurled tube, and rotate the handle clockwise.

4.1.1.5 Connect the Blade Handler tool to the VACUUM outlet on the right front cover of the machine.

4.1.1.6 Place the Blade Handler over the front of the spindle, firmly against the face of the saw blade to form a vacuum seal.

4.1.1.7 Slowly pull the blade from the spindle.

NOTE: If blade is tight on the spindle, rock the handler up and down or to the side while removing the blade from the spindle.

4.1.1.8 Place the blade on the Blade Stand and release the vacuum by pressing the vacuum release button on the end of the handler.

4.1.1.9 If the blade is to be saved, place a plastic guard ring on it and remove it from the stand. Damaged blades should be discarded.

4.1.1.10 Clean the flange face and spindle shaft surfaces of all debris. These surfaces must be clean to insure proper alignment of the blade with the shaft.

4.1.1.11 Place a new blade on the Blade Stand with the white guard ring facing up.

4.1.1.12 Remove the guard ring by firmly holding the blade hub against the stand and gradually prying the ring off by working the Guard Removal Tool around the outside edge of the ring.

CAUTION: Do not touch the blade. It is very fragile and can be easily damaged.

4.1.1.13 Lower the Blade Handler over the Blade Stand against the blade hub to make a vacuum seal.

4.1.1.14 Remove the blade from the Blade Stand.

4.1.1.15 Place the blade on the spindle shaft. Make sure it is seated against the spindle flange.

4.1.1.16 Release the vacuum by holding the Vacuum Switch button and remove Blade Handler.

4.1.1.17 Make sure the face of the spindle nut is free of debris. Place it on the end of the spindle with the large-diameter face against the blade.

4.1.1.18 Tighten the spindle nut with the Spindle Nut Wrench.

4.1.1.19 Turn the nozzle retractor screw counterclockwise until the nozzle strikes the adjustment setscrew.

4.1.1.20 Turn the spindle on and check for correct water flow.

4.1.1.21 Readjust the height indicator as described in Section 4.1.5.

4.1.1.22 Replace the plastic covers.

DICING

4.1.2 Fill lubricant tank with KERF-AID as required.

4.1.3 Apply a protective coating of AZ1350J photoresist to wafer per PEI 7.18.17.

4.1.4 Mounting substrates to glass mounting plate.

4.1.4.1 Mount quartz substrates using optical mounting pitch as described below:

a. Preheat hot plate to 125 ± 5°C.

b. Place the glass mounting plate on the hot plate and allow 3-5 minutes for temperature stabilization.

c. Apply the mounting pitch to the mounting plate and spread with the rod end of a Q-tip.

d. Place the quartz substrate on the mounting pitch and press the substrate with a wooden probe in circuit free areas for intimate contact.

e. Remove and allow to cool to room temperature.

4.1.4.2 Mount lithium niobate substrates to a glass mounting plate using double back masking tape.

4.1.5 Perform blade height adjustment as described below after approximately 5 hours of cutting time, dressing the blade or changing the blade.

4.1.5.1 Rotate the HEIGHT ADJUST knob clockwise to maximum height.

4.1.5.2 Set BLADE to ON and set HEIGHT ADJUST/RUN switch to HEIGHT ADJUST. This will allow the blade to come down without the water being on.

4.1.5.3 Set AUTO/MAN switch to AUTO.

CAUTION: Do not cut fast or deep while in HEIGHT ADJUST or the blade will be damaged due to the lack of cooling water. Do not cut deeper than 0.001 inch or faster than 0.3 inches per second without water.

DICING

4.1.5.4 Place the MODE selector in CUT and turn the SPEED ADJUST valve fully clockwise (closed).

4.1.5.5 Press the START/STOP button. Slowly turn the SPEED ADJUST VALVE counterclockwise (open) until the wafer is under the saw blade. Close the SPEED ADJUST valve, stopping the X-axis carriage.

4.1.5.6 Slowly lower the blade by turning the HEIGHT ADJUST knob counterclockwise while observing the distance between the blade and the wafer.

4.1.5.7 Lower the blade until it just clears the wafer.

4.1.5.8 Open the SPEED ADJUST valve slightly so that X-axis will cycle slowly back and forth. Lower the blade in 0.0005-inch steps per pass until a scratch is made across the wafer. If necessary, use the microscope to determine when contact has been made.

4.1.5.9 Turn the MODE selector to LOAD. Press the START/STOP botton.

4.1.5.10 Lower the blade height to the desired depth of cut.

4.1.5.11 Set the HEIGHT ADJUST/RUN switch to RUN.

NOTE: These processes are to be performed only with the concurrence of your supervisor or a process engineer.

An alternate visual method is to use the above procedure but contact the top of the chuck. Do not put a wafer on the chuck. Once contact is made, adjust the height up a distance equal to thickness of the material that is to remain below the cut.

A third visual method is to make contact with a shim equal in thickness to the material that is to remain below the cut.

4.1.6 Final setup adjustments.

4.1.6.1 Prior to making a production run, the following adjustments should be made. They are used to set up a programmed sequence for a particular wafer geometry. New adjustments must be made for each new wafer geometry.

4.1.6.2 Wafer size: Three wafer size limits are selected by the WAFER SIZE switch. Use Wafer Size 2 for wafers up to 2 1/4 inches in diameter. Size 3 is for wafers between 2 1/2 and 3 1/4 inches in diameter. Size 4 is for wafers between 3 1/4 and 4 1/4 inches. Select the proper setting as specified on the Standard Flow Sheet and dial it in on the WAFER SIZE switch.

4.1.6.3 Speed: Adjust the speed as specified on the Standard Flow Sheet. Speed in the cutting direction (left-to-right) is controlled by the SPEED ADJUST knob and displayed in inches per second. Speed is only sampled once per X-axis cycle; therefore, it must be adjusted while the X-axis is cycling back and forth. For a correct reading do not adjust speed during the cutting pass. The speed indication is a timed pulse rate from a linear encoder and it latches the readouts to results of the last pass. The reading remains until another X-axis pass is completed.

4.1.6.4 Index settings: Index settings are determined by following the procedure outlined below.

1. Select an identifiable mark on the wafers so they can always be palced on the chuck in the same direction.
2. Set the chuck to the Phase A position and place a wafer on it.
3. Dial in the A index distance as specified on the Standard Flow Sheet for the horizontal streets.
4. Dial in the B index distance as specified on the Standard Flow Sheet for the vertical streets.
5. Verify index settings by first jogging the center of a street to the microscope reticle and then make one index. It should index to the center of the next street.
6. To check the B index settings, release the chuck lock and rotate the chuck to Phase B position. The wafer should index from the center of one street to the next as it did in Phase A.
7. If the street spacing in unknown, dial in .0100 inch (0.100 mm) on the Phase A index switch.

4.1.6.4 Index settings: (Continued)

8. Align a wafer street center with the microscope reticle in Phase A. Continually index, counting the number of indexes until the reticle crosses the center of the next street. Jog back to realign the reticle with the original street. Dial the number of counted indexes times 0.0100 into the INDEX DISTANCE digitswitch.

9. Make a single index and observe the relationship to the next street.

10. Return one index to the center of the original street and add a few mils (less than 10) to the index setting and repeat Step 9.

11. Readjust the index settings until one index moves the wafer exactly one street.

NOTE: Always return to the original street before changing the index setting in order to eliminate jogging each time.

12. Rotate the chuck to the Phase B position and repeat the above procedure. (Steps 7-11).

This method is recommended over the simple trial and error method which may easily result in index settings that are hard-to-detect multiples of the true street spacing.

4.2 Process instructions.

4.2.1 Place a wafer on the vacuum chuck.

4.2.2 While observing through the microscope, rotate the wafer until a street is roughly aligned with the cross hair. Set the CHUCK VACUUM to ON.

4.2.3 Set the MODE selector to ALIGN and press the START/STOP button. The chuck will cycle from side-to-side under the microscope.

4.2.4 Observe the relation of the street to the crosshair and adjust the Theta knob until the street runs parallel to the crosshair.

4.2.5 Jog the Y-axis until the crosshair is in the center of a street.

4.2.6 Turn the MODE selector to CUT. The blade will automatically go to the rear of the wafer, the blade will lower, the cooling water will start flowing, and the X-axis will travel to the right, cutting the wafer. When the blade reaches the end of the wafer, it will lift and the Y-axis will index to the next street while the X-axis returns to the left at high speed. This entire cycle will repeat until the wafer is completely scribed in one axis. When the entire cycle is complete, the blade will then return to its Home position. To vefify alignment, the cycle can be stopped at any time by pressing the START/STOP button. The cycle can be restarted by pressing the START/STOP button a second time and the cycle will continue. Each time it is restarted, however, the chuck will go the the Home position, at the far left, before completing the previous cut. The operator can, therefore, stop the cutting at any time, then restart to move the chuck to the far left and then stop it a second time as desired under the microscope to observe the cut. By repeatedly starting and stopping, the operator can observe any desired location on the street. When stopped in the Auto-Cut mode, the manual controls are reactivated to allow jogging or indexing as required. Always return the Y-axis to the street that it was stopped on in order to ensure cutting of all streets.

4.2.7 Press and hold the CHUCK RELEASE button while rotating the chuck to the 90° detent. Release the button and the chuck will lock in place. The system's electronic circuitry will atuomatically switch to the Phase B index switch.

4.2.8 Set the MODE selector to ALIGN and press the START/STOP button.

4.2.9 Check the Theta alignment and readjust if necessary.

4.2.10 Scan or jog the crosshair to the center of a street.

4.2.11 Turn the MODE selector to CUT. The saw will automatically cut all the streets at the Phase B index spacing in the same manner as it cut during Phase A.

4.2.12 Press and hold the CHUCK RELEASE button while rotating the chuck back to its original position. Release the button to lock the chuck in the starting position (Phase A) for the next wafer.

DICING

4.2.13 Turn the CHUCK VACUUM OFF and remove the wafer.

NOTE: If vacuum is removed while Theta is still in Phase B cut position, an alarm will sound to warn that the chuck is not in the correct starting position for the next wafer.

4.2.14 If the wafer cannot be removed easily because of suction caused by the wafer under it, then press the WAFER AIR button to inject air pressure into the chuck, thus, lifting the wafer and releasing the suction.

4.3 Shut-down.

4.3.1 Not applicable.

5.0 REFERENCES

5.1 Government standards and specifications.

5.1.1 Not applicable.

5.2 Internal specifications and instructions.

5.2.1 PEI 7.18.17, Photoresist Application (Spinning).

HUGHES HUGHES AIRCRAFT COMPANY GROUND SYSTEMS GROUP	ENGINEERING DIVISION PROCESS ENGINEERING INSTRUCTION MICROELECTRONICS **instruction**	
Subject TOROID ATTACH TO SAW HYBRIDS	Page 1 of 2 Issue 2-8-78 Approved [signature] Approved [signature]	Number 7.18.23 Revision – Date 1-30-78 Date 2-8-78

1.0 SCOPE

1.1 This instruction describes the internal connection of a tuning coil (toroid) to package leads.

2.0 EQUIPMENT AND MATERIAL REQUIRED

2.1 Equipment.

2.1.1 Low Power Microscope ~ 40 X.

2.1.2 Temperature controlled soldering iron (2 each)

2.1.3 Tweezers.

2.1.4 Wire cutters.

2.1.5 N_2 blow gun.

2.2 Materials.

2.2.1 Platform package (as specified).

2.2.2 Toroids (as specified).

2.2.3 Rosin core solder (Sn 60/Pb 40, 63/37 or as specified) per QQ-S-571 and MIL-F-14256.

2.2.4 Isopropanol, reagent grade or equivalent.

2.2.5 Dry Nitrogen, 99.9% purity.

3.0 GENERAL REQUIREMENTS OR INSTRUCTIONS

3.1 When SAW devices are to be packaged with internal tuning, the tuning elements must be interconnected in a manner that is compatible with subsequent processing such as themo-compression bonding.

4.0 PROCEDURE

4.1 Startup.

TOROID ATTACH TO SAW HYBRIDS

4.1.1 Set temperature of one soldering iron so that it is hot enough to flow solder around package pin, but not hot enough to cause the solder to "wick" up the pin and over the top.

4.1.2 (Optional) Set temperature of other soldering iron to solder toroid lead properly to the package itself.

4.2 Process Instructions.

4.2.1 Wrap pre-tinned toroid lead around package lead, at least 1 but less than 2 full turns.

4.2.2 Apply heat to wire and pin with the iron described in 4.1.1 and apply solder to wire-pin junction.

4.2.3 Remove heat when solder has been observed to flow forming a smooth fillet between the pin and the wire.

4.2.4 If required, solder one lead to the package by applying solder and heating the wire against the package using the soldering iron described in 4.1.2.

4.2.5 Remove heat when solder has been observed to flow forming a smooth fillet between the wire and the package.

4.2.6 Clip excess lead lengths.

4.2.7 Clean flux residue from package with isopropanol. Blow dry with dry nitrogen.

4.2.8 Check that bare toroid wire does not short against package unless the assembly drawing shows it to be grounded.

4.3 Shutdown.

4.3.1 Turn off soldering iron(s).

5.0 <u>REFERENCE</u>

5.1 Government standards and specifications.

5.1.1 Not applicable.

5.2 Internal specifications and instructions.

5.2.1 Not applicable.

HUGHES

HUGHES AIRCRAFT COMPANY
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ENGINEERING DIVISION
PROCESS ENGINEERING INSTRUCTION
MICROELECTRONICS

instruction

Subject	Page 1 of 2	Number 7.18.24
SURFACE ACOUSTIC WAVE DIE MOUNT	Issue 2-3-78	Revision –
	Approved T. Montana	Date 2-2-78
	Approved	Date 2-3-78

1.0 SCOPE

1.1 This instruction describes the mounting of the SAW die to a package or substrate.

2.0 EQUIPMENT AND MATERIALS REQUIRED

2.1 Equipment.

2.1.1 Dispenser (Hughes RTV dispenser or equivalent).

2.1.2 Tweezers, style 5 or equivalent.

2.1.3 Syringe.

2.2 Materials.

2.2.1 Dow Corning 3140 or 3144 RTV or equivalent per MIL-A-46146.

3.0 GENERAL REQUIREMENTS OR INSTRUCTIONS

3.1 The SAW die is to be securely attached to a package or a substrate in such a way as to provide minimal mechanical stress to the crystal and absorb excess acoustic energy at ends of crystal.

4.0 PROCEDURE

4.1 Startup.

4.1.1 Determine that dispenser and/or syringe has adequate RTV and that it is not plugged.

4.1.2 Assure that the RTV is being dispensed in the quantity and location required. Adjust per Process Engineer's instructions, if necessary.

4.2 Process Instruction.

4.2.1 Hughes dispenser operation.

4.2.1.1 Place package or substrate on dispenser stage.

4.2.1.2 Raise stage to uppermost position.

SURFACE ACOUSTIC WAGE DIE MOUNT

4.2.1.3 To dispense RTV, slide stage away from the operator to the stop.

4.2.1.4 Partially lower stage, approximately .1 inches.

4.2.1.5 Slide stage toward the operator to the stop.

4.2.1.6 Lower stage to lowest position.

4.2.1.7 Remove package or substrate.

4.2.2 Hand dispense.

4.2.2.1 Using syringe or other suitable applicator dispense material by hand CAREFULLY.

4.2.3 Place crystal on top of RTV bead and press into place making sure there are no air gaps between crystal and package or substrate.

4.2.4 Apply RTV to the ends of the crystal, wrapping it up over the end to cover the top surface a distance roughly equal to half the total distance from the end of the transducer pattern to the end of the crystal.

4.2.5 Place parts in an open area under laminar flow for RTV to cure (24 to 72 hours).

4.3 Shutdown.

4.3.1 Seat RTV dispenser tube.

5.0 REFERENCES

5.1 Government standards and spcifications.

5.1.1 MIL-A-46146 Adhesive-Sealants, Silicone, RTV, Non-Corrosive (For use with sensitive metals and equipment).

5.2 Internal specifications and instructions.

5.2.1 Not applicable.

HUGHES HUGHES AIRCRAFT COMPANY GROUND SYSTEMS GROUP	ENGINEERING DIVISION PROCESS ENGINEERING INSTRUCTION MICROELECTRONICS **instruction**		
Subject PULSED TIP THERMO-COMPRESSION WIRE BONDING	Page 1 of 17	Number 7.18.25	
	Issue 2-2-78	Revision -	
	Approved [signature]	Date 1-30-78	
	Approved [signature]	Date 2-2-78	

1.0 SCOPE

This instruction covers the attachment of gold wires between microelectronic devices and header, flatpack, or substrate using pulsed tip thermo-compression techniques.

2.0 EQUIPMENT AND/OR MATERIAL REQUIRED

2.1 Equipment.

2.1.1 Hughes pulse tip thermo-compression wire bonder Model 360, with microscope and light capable of 30X magnification, or equivalent.

2.1.2 Hughes MA-16-10 Heater and Gas Controller.

2.1.3 Hughes MA-16-02B Temperature Calibrator.

2.1.4 Appropriate header adapters.

2.1.5 Gram gauge, 25-150 gram. Haldex AB or equivalent.

2.1.6 Tweezers.

2.1.7 Hughes bonding tools:

2.1.7.1 EBB-07-3 for .0007" wire.

2.1.7.2 EBB-1-15 for .001" wire.

2.1.7.3 EBB-15-15 for .0015" wire.

2.1.7.4 EBB-2-15 for .002" wire.

2.1.7.5 EBB-5-15 for .005" wire.

2.1.8 Hydrogen Flame Orifice.

2.1.8.1 5000-2 for .0007" wire.

2.1.8.2 5000-3 for .001-.0015" wire.

2.1.8.3 5000-4 for .002" wire and larger.

PULSED TIP THERMO-COMPRESSION WIRE BONDING

2.2 Material.

2.2.1 Gold wire; 2 - 5 percent elongation; 99.99 percent purity wound on TC-1 copper light spun wire spool. Single winding required per 760660, or equivalent. Size as required.

2.2.2 H_z gas supply, 5 psi minimum.

2.2.3 N_2 gas supply, 3 psi minimum.

2.2.4 Die - header or die-flat pack assemblies.

2.2.5 Finger cots.

3.0 GENERAL REQUIREMENTS OR INSTRUCTIONS

3.1 Pulsed tip thermo-compression bonded gold wire is used to interconnect microelectronic parts to package or hybrid leads or to other internal components within the same package or hybrid.

3.2 All bonds shall meet the requirements of MIL-STD-883, PEI 7.15.22, PEI 7.16.14, 780335 and Tables I and II of this document.

3.3 The process is to be performed only by qualified operators per PEI 7.16.03.

3.4 The work station must be kept clean and free of contaminants.

4.0 PROCEDURE

4.1 Setup.

4.1.1 Install the bonding tip in the holding clamps. Make sure that the screw used in clamping holds the bonding tip assembly securely and that the top of the shank is positioned against the stop provided for it. The shanks must be pressed firmly to the back of the holding clamps, otherwise the bonding surface of the capillary will not be parallel to the working surface and inconsistent bonds and pulloffs may result. During this mounting make certain that the power is turned off because any movement of the tip may activate the heating cycle.

4.1.2 Temperature Calibration (With MA-16-02B)

4.1.2.1 Set up HPB-360 bonder as follows:

Temp Calibrate 5
Temperature. . . . . 10 (All channels)
Time At Temp . . . . 3.0 (All channels)

4.1.2.2 Connect thermocouple to Model MA-16-02 CALIBRATOR via front panel jack.

4.1.2.3 Install thermocouple in top of capillary after removing the gold bonding wire. Arrange thermocouple lead wire so that base of thermocouple holder is approximately level.

4.1.2.4 Lift bonder flexure assembly to initiate bond heating pulse and observe temperature indication. Bonder must be in AUTOMATIC and one of the three channel lights must be on.

4.1.2.5 Increase TEMP CALIBRATE thumbwheel a few steps at a time until 450°C temperature indication is reached.

4.1.2.6 If temperature indication is above 450°C. with TEMP CALIBRATE set at .5 it will be necessary to use a lower TEMPERATURE thumbwheel setting for the capillary.

4.1.2.7 If 450°C cannot be reached with TEMP CALIBRATE at maximum (3.6), TEMPERATURE at 20 and TIME AT TEMP at 3.0, then check capillary tip for defective connections.

4.1.3 Install wire spool. Facilities for both a large spool or a small spool are provided. If a large spool is to be used, remove the glass cover from the spool holder. Install the spool on the foam plastic cylinder. Thread the wire through the hole in the glass cover and replace the glass cover on the spool holder. Be careful that the glass cover does not make contact with the spool of wire during installation. Position the fabric-lined clip onto the small spool mounting cylinder above the tail puller. Remove small spool dust cover when the large spool is used.

If a small spool is to be incorporated it will not be necessary to mount the large reel holder. Instead remove the feltlined clip-on from the Teflon cyiinder, install the wire spool on the Teflon cylinder, and cover the wire with the plastic dust tube provided.

4.1.4 CAUTION! TURN THE POWER SWITCH OFF WHILE THREADING CAPILLARY.

If the two-inch spool of wire is to be used, thread the wire from the glass cover over the Teflon guide and under the clip that mounts on the guide. Thread the wire through the wire guide near the jaws of the wire puller and then through the capillary tip.

Turn the machine on. This will open the clamps so that the wire will locate itself between the jaws of the wire clamp.

4.1.5 Turn on the hydrogen pressure and set the regulator to 5 psi.

4.1.5.1 Bleed the hydrogen line to the unit and connect the hose to the hose connector located on rear of cabinet. Make sure the hydrogen hose is free of contamination.

4.1.5.2 Ignite hydrogen pilot with a match and adjust flame size to about .10 diameter ball with the needle valve located on the front face of the flame-off head.

4.1.6 Move the Z-motion handle to the right. The bonding sheet will go up to the flame-off position, hesitate for as long as the timer requires, and then return to the search height position. At initial startup, it will probably be necessary to operate the valve several times before the hydrogen fills the tube and ignites at the tip.

4.1.6.1 If the Z-lever is held in the "PULL & BALL" position and not released, the bonding tip will move to the flame-off position and remain there until the handle is released. The flame will still be controlled by gas timer. This action allows accurate positioning of the flame-off tip.

4.1.7 Search Height Adjustment.

4.1.7.1 Turn the power supply on. Place a sample substrate in the work chuck and set the #3 search height to the lowest level desired. If a second search height and/or bonding schedule is required, set the #2 search height by adjustment of the search height knob. The search height in which the Z-lever is positioned will be indicated by a light on the left hand front panel. If a third height or bonding cycle is required, another search height (#1) is available.

4.1.7.2 Turn the manual-automatic selector switch to automatic. CAUTION: NEVER operate the unit when the search level lights are off. When in automatic, all three lights operate separately, but only the one that indicates the selected search height will be lighted. Should more than one search height indicator light be on, the search height detents are not accurately adjusted.

4.1.7.3 Position the Z-motion lever so that the appropriate search height light is on. It is usually best to start with #3 and the search height about .020 above the bonding area. The unit will operate with a search height from 0 to .100 inches.

4.2 Process.

4.2.1 Set Capillary Time, Temperature and Weight as prescribed by the cognizant engineer.

4.2.2 Adjust the search heights as in paragraph 4.1.7.

4.2.3 Set work stage temperature as prescribed by cognizant engineer and allow 10 minutes warm up.

4.2.4 Put the Automatic/Manual Switch in Automatic Mode.

4.2.5 Load substrate onto heat column.

4.2.6 Manipulate chessman handle and Z-lever to place capillary over bonding point on die. Select the appropriate search height.

NOTE: Refer to assembly diagram for bond location and termination point of each wire to be bonded.

4.2.7 Actuate the Z-lever to the left and produce a ball bond.

4.2.8 Raise the Z-lever to the appropriate search position and locate the area for bond termination. Actuate the Z-lever to the left and produce a wedge bond.

4.2.9 Actuate the Z-lever to the right to flame-off.

4.2.10 If the wire clamp is not used, wire tails must be pulled off with tweezers.

4.2.11 Repeat Steps 4.2.6 through 4.2.10 for all bonds required.

4.2.12 Remove substrate from work stage.

4.3 Shutdown.

4.3.1 Turn off machine microscope light.

4.3.2 Turn off machine power supply.

4.3.3 Turn off hydrogen and extinguish flame.

5.0 REFERENCES

5.1 Government Standards and Specifications.

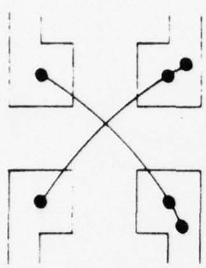
5.1.1 Not applicable.

5.2 Internal Specifications and Instructions.

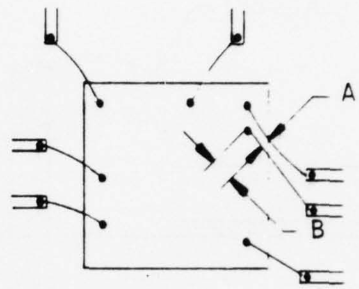
5.2.1	760660	Wire, Gold, for Microelectronic Circuits
5.2.2	PEI 7.15.22	Bonding Wire Acceptance Inspection
5.2.3	PEI 7.16.14	Non-Destruction Pull Test of Wire Bonds

THERMOSONIC GOLD BALL BONDING

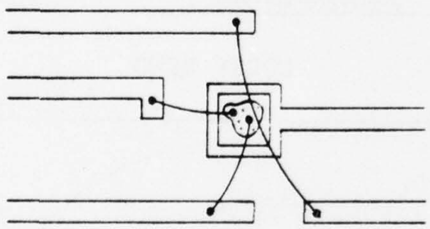
TABLE I : UNACCEPTABLE BONDS



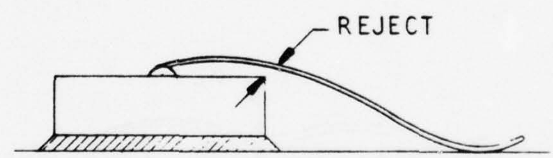
LEAD WIRE CROSSOVER



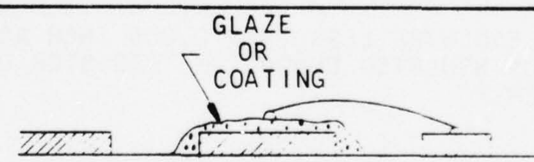
LEAD WIRES TOO CLOSE WHERE A IS LESS THAN 0.005 INCH AFTER A DISTANCE OF 0.010 INCH FROM THE WIRE TO SUBSTRATE BOND (B)



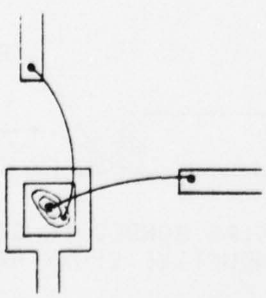
WIRE CROSSES OVER CHIP



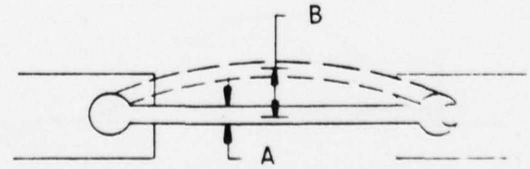
LEAD WITHIN 0.005 INCH OF CHIP EDGE



LEAD WIRE BONDED TO GLAZE OR COATING RATHER THAN PAD



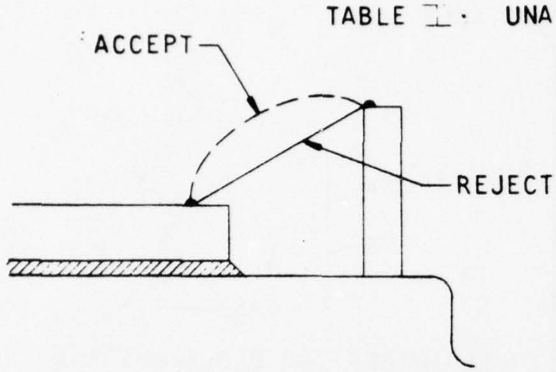
LEAD WIRES CROSS



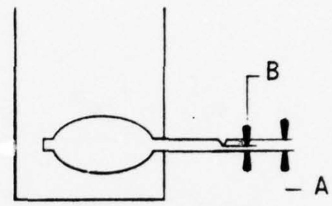
LEAD DISPLACEMENT B MORE THAN 3 TIMES DIAMETER OF A WHEN VIEWED FROM ABOVE

THERMOSONIC GOLD BALL BONDING

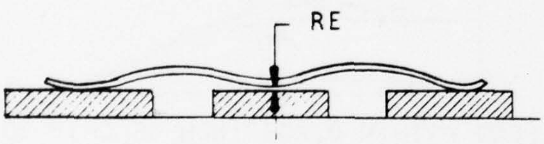
TABLE I. UNACCEPTABLE BONDS



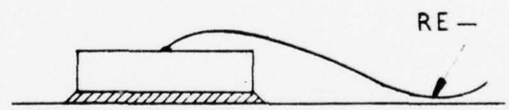
STRESS RELIEF IN LEAD WIRE LESS THAN 3 WIRE DIAMETERS WHEN WIRE IS MORE THAN 0.005 INCH IN LENGTH



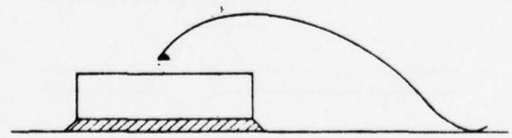
NICKS, CUTS, CRIMPS OR SCORING IN LEAD WIRE WHERE B IS LESS THAN 75 PERCENT OF A



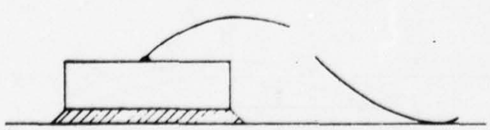
LEAD WIRE LESS THAN 0.005 INCH ABOVE UNINSULATED CONDUCTOR, RESISTOR OR CHIP



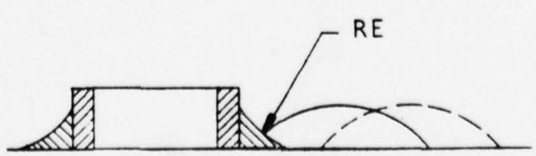
LOOSE BOND



LOOSE BOND



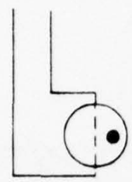
BROKEN LEAD WIRE



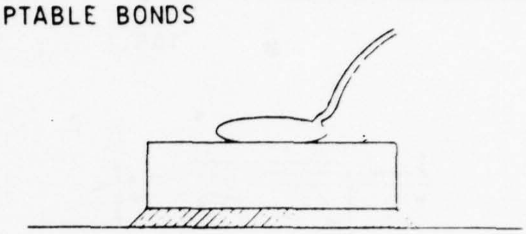
LEAD WIRE BONDED TO SOLDER JOINT OR CONDUCTIVE EPOXY RATHER THAN PAD

THERMOSONIC GOLD BALL BONDING

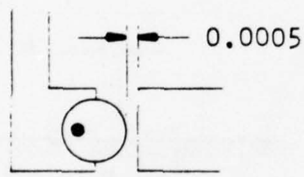
TABLE I: UNACCEPTABLE BONDS



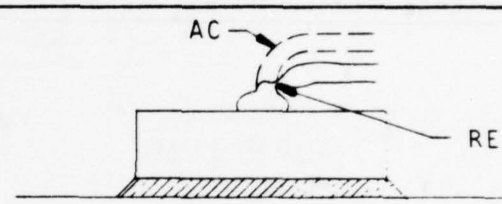
BASE OF LEAD WIRE ON BALL BOND NOT WITHIN PAD AREA



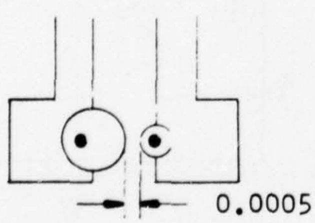
LEAD WIRE DISPLACED TO SIDE OF BALL



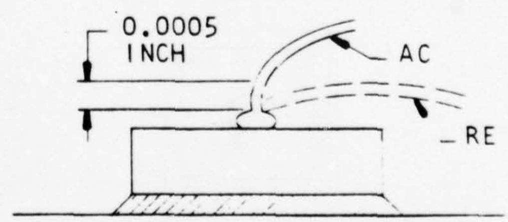
BOND WITHIN 0.0005 INCH OF ADJACENT METALLIZED AREA



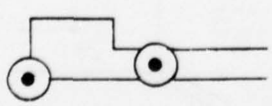
LEAD NECKING EXCEEDS 25 PERCENT OF LEAD DIAMETER



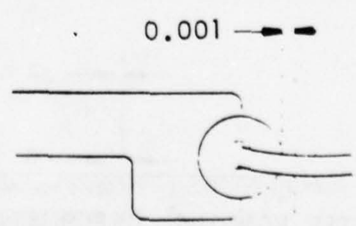
LEAD BONDS LESS THAN 0.0005 INCH DISTANT



BEND TO CLOSE TO BALL



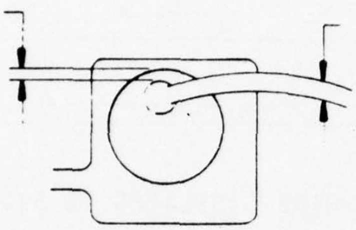
LESS THAN 50 PERCENT OF BALL WITHIN SUBSTRATE PAD AREA



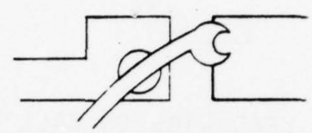
LESS THAN 1 MIL OF OXIDE SEPARATING BOND AND DIE EDGE

THERMOSONIC GOLD BALL BONDING

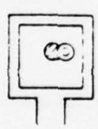
TABLE I : UNACCEPTABLE BONDS



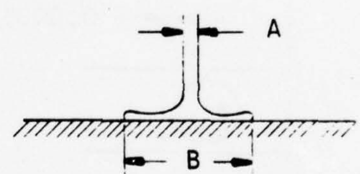
WIRE EXIT LESS THAN 1/2 D FROM PERIPHERY (BALL BONDS ONLY)



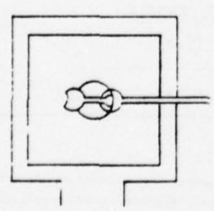
BOND SHORTS ADJACENT METALLIZED AREA



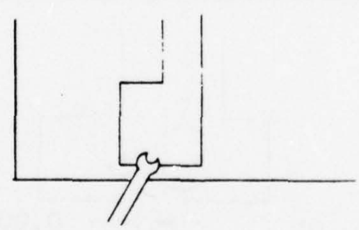
BALL BOND MORE THAN 50 PERCENT OFF CONTACT AND/OR TOUCHING CHIP SURFACE



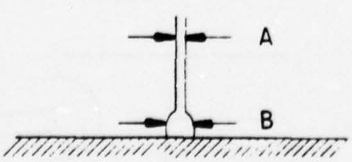
AFTER BONDING, BALL DEFORMED MORE THAN 5 TIMES THE DIAMETER OF THE WIRE; B IS GREATER THAN 5 TIMES A



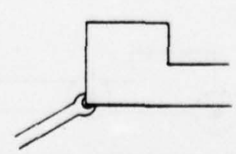
SINGLE WEDGE BOND OR THE FIRST OF TWO WEDGE (STITCH) BONDS MORE THAN 50 PERCENT OFF CONTACT AND/OR TOUCHING CHIP SURFACE



BOND ON EDGE OF BONDING PAD OF CHIP OR SUBSTRATE



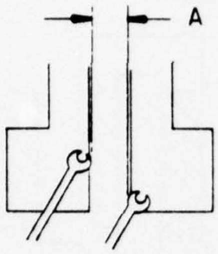
AFTER BONDING, DEFORMATION OF BALL IS LESS THAN 2 TIMES THE DIAMETER OF THE WIRE; B IS LESS THAN 2 TIMES A



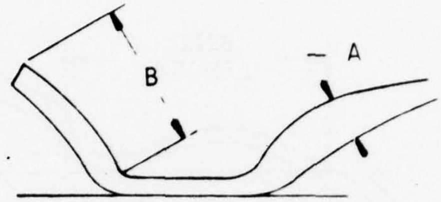
LESS THAN 50 PERCENT OF FIRST WEDGE (STITCH) BOND WITHIN PAD AREA

THERMOSONIC GOLD BALL BONDING

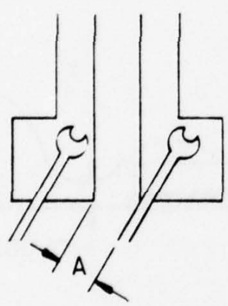
TABLE I: UNACCEPTABLE BONDS



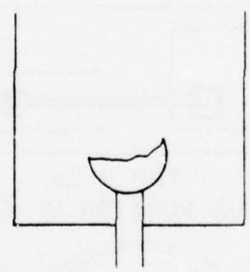
BONDS TOO CLOSE WHEN A IS LESS THAN 0.0005 INCH



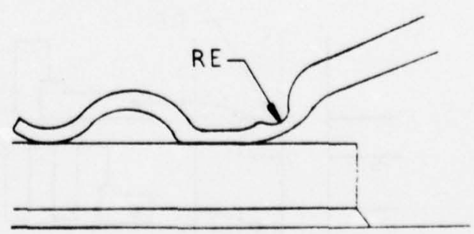
TAIL ON BOND IS LONGER THAN 0.003 INCH



ADJACENT PAD AND CONDUCTOR ARE TOO CLOSE WHEN A IS LESS THAN 0.0005 INCH



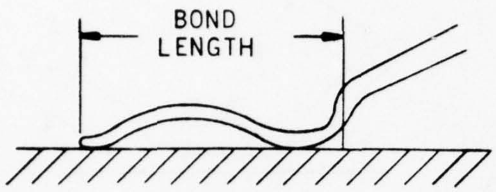
PORTION OF SINGLE WEDGE BOND MISSING WHERE LESS THAN 0.75 DESIGN SIZE REMAINS



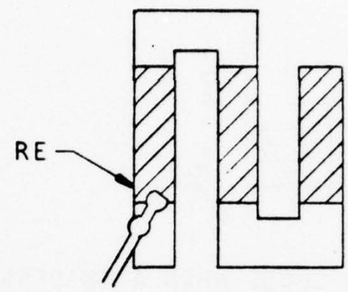
LEAD NECKING EXCEEDS 25 PERCENT OF WIRE DIAMETER

THERMOSONIC GOLD BALL BONDING

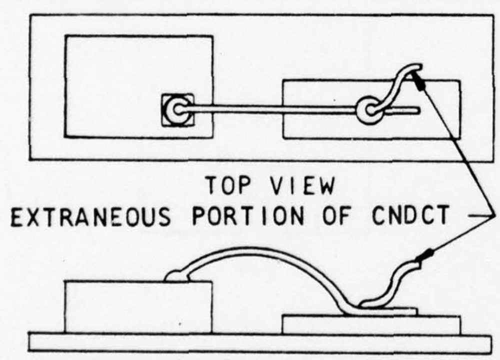
TABLE I: UNACCEPTABLE BONDS



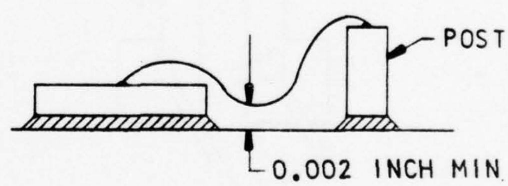
LESS THAN 25 PERCENT OF A SINGLE WEDGE BOND CONTACTS PAD



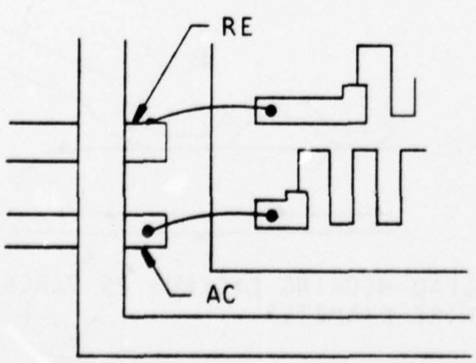
WIRE BOND ON RESISTOR



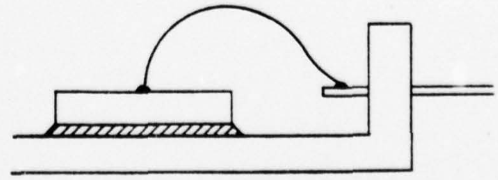
THERE IS NO EVIDENCE OF ELECTRICAL CONNECTION AT THE END OF WIRE



LEAD LESS THAN 0.002 INCH ABOVE SURFACE OF SUBSTRATE



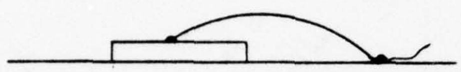
BOND NOT COMPLETELY WITHIN CONFINES OF PACKAGE LAND FLAT



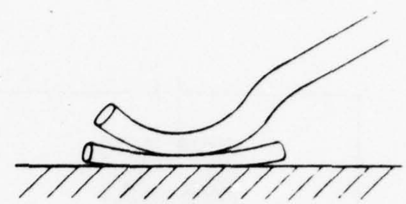
LEAD WIRE EXCEEDS TOP OF FLAT PACK FRAME

THERMOSONIC GOLD BALL BONDING

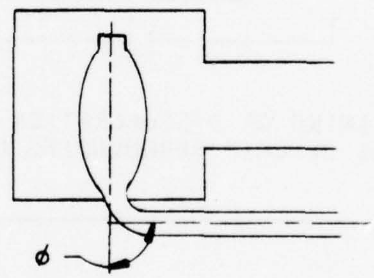
TABLE I : UNACCEPTABLE BONDS



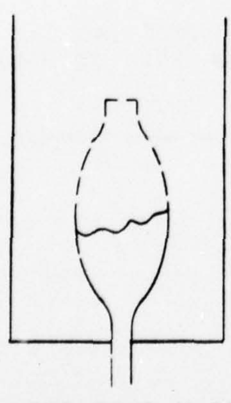
EXCESSIVE LEAD TAIL



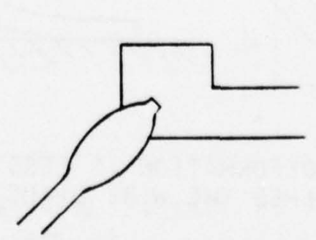
NEW BOND FORMED OVER OLD BOND



BONDWIRE BENT AT MORE THAN 45 DEGREES. ø IS GREATER THAN 45 DEGREES



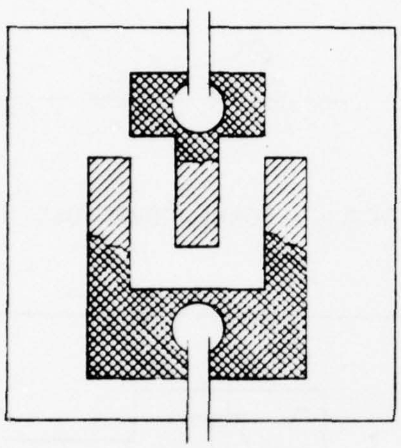
PORTION OF LEAD BOND MISSING WHERE LESS THAN 0.75 DESIGN SIZE REMAINS. THIS APPLIES ONLY TO ALUMINUM WIRE BONDED ULTRASONICALLY



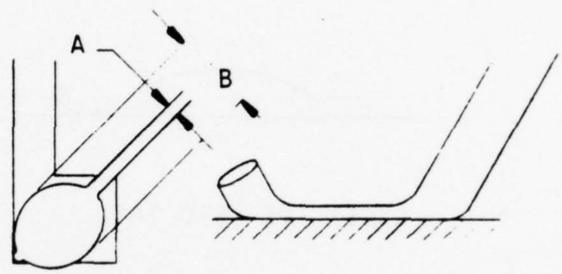
LESS THAN 50 PERCENT OF BOND WITHIN PAD AREA

THERMOSONIC GOLD BALL BONDING

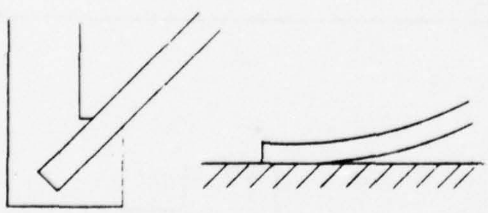
TABLE I: UNACCEPTABLE BONDS



DARKENING OR DISCOLORATION ON ACTIVE AREAS OF CHIP SURROUNDING LEAD BONDS



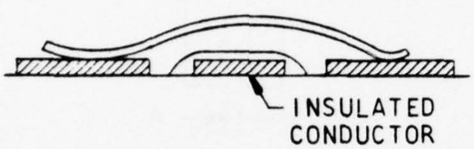
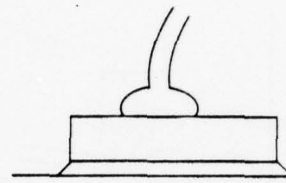
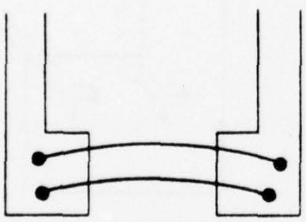
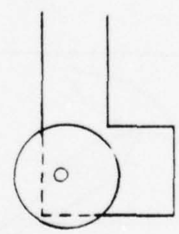
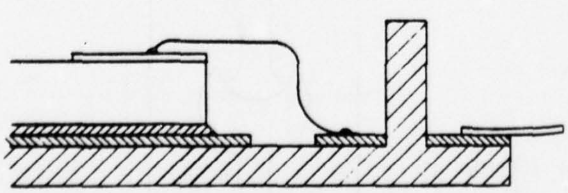
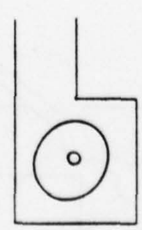
EXCESSIVE BOND DEFORMATION WHERE B IS MORE THAN 3 TIMES DIAMETER A



BOND DEFORMATION IS LESS THAN 1.2 TIMES THE WIRE DIAMETER

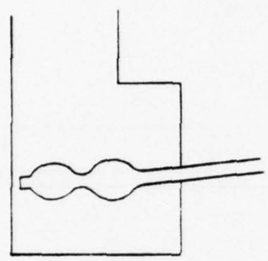
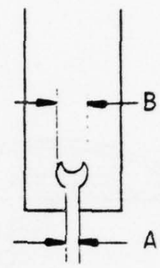
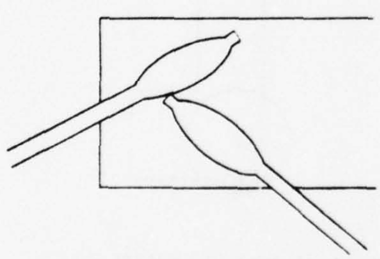
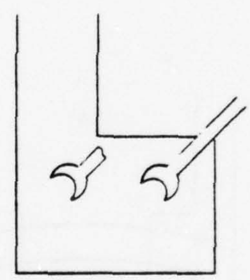
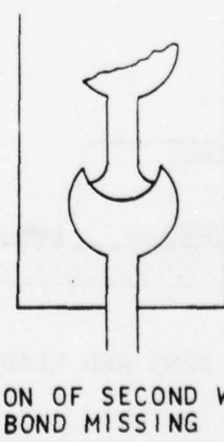
THERMOSONIC GOLD BALL BONDING

TABLE II : ACCEPTABLE BONDS

 CROSSOVER CONDUCTOR INSULATED OR GLAZED	 OPTIMUM BALL BOND
 REDUNDANT LEAD BONDS	 SLIGHTLY MISALIGNED BALL
 GOOD BOND AND LEAD DRESS	 SLIGHTLY DEFORMED BALL

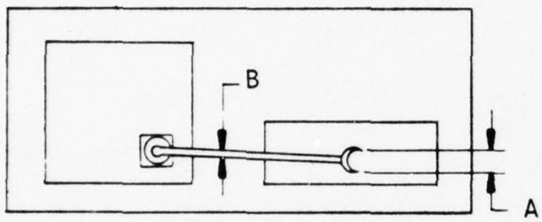
THERMOSONIC GOLD BALL BONDING

TABLE II : ACCEPTABLE BONDS

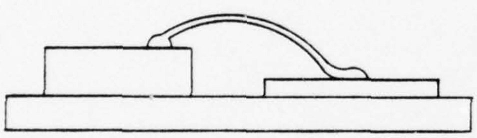
 SINGLE OR DOUBLE IMPRESSION ON BOND FOOT	 GOOD WEDGE BOND B IS 1.2 TO 3.0 TIMES A
 TWO BONDS ON SAME PAD TOUCH	 ANY NUMBER OF REBONDS PER PAD, AS L LONG AS THE INTERCONNECTING CONDUCTIVE PATH IS NOT REDUCED BY MORE THAN THE MINIMUM LINE WIDTH
 SLIGHTLY MISALIGNED WEDGE	 ANY PORTION OF SECOND WEDGE (STITCH) BOND MISSING

THERMOSONIC GOLD BALL BONDING

TABLE II : ACCEPTABLE BONDS



TOP VIEW



SIDE VIEW

GOOD BOND. IF THE WIDTH OF A DOES NOT EXCEED 5 TIMES B TO HALF-MOON TYPE OF BOND OBTAINED WITH GOLD WIRE, ULTRASONICALLY BONDED, IS ACCEPTABLE.

MATERIAL SPECIFICATIONS

HUGHES
HUGHES AIRCRAFT COMPANY

HUGHES AIRCRAFT COMPANY
GROUND SYSTEMS GROUP
FULLERTON, CALIFORNIA

CODE IDENT NO. 05869

MATERIALS AND PROCESSES
CHANGE NOTICE

SPEC 760781 REV A ☐ AMEND 1 ☒ STATUS ACTIVE ☒ INACTIVE ☐

SINGLE CRYSTAL QUARTZ FOR
SURFACE ACOUSTIC WAVE DEVICES

Specification 760781 is amended as follows:

1. Page 3, Table II. Revise as follows:

Table II: Eulerian Angles for Orientation of Crystalline Structure

Identifying Number	Orientation	Eulerian Angles (degrees)		
		ϕ $\pm 0.25°$	θ $\pm 0.25°$	ψ $\pm 0.5°$
760781-10	ST-X	0	132.75	0
760781-11	YX	0	90	0
760781-100	ST-X	0	132.75	0
760781-110	YX	0	90	0

STANDARD
GSG GSG
RELEASE

DATE: 28 July 1978 ENGINEER: G. M. Dowell

APPROVED: [signature]

D10-024 GS 2/73

GROUND SYSTEMS MATERIAL SPECIFICATION

APPROVED - MATERIALS & PROCESSES	HUGHES AIRCRAFT COMPANY GROUND SYSTEMS GROUP FULLERTON, CALIF. 92634 CODE IDENT. NO. 05869	760781	REV: A
APPROVED: R. H. Kort		ISSUE DATE 75-04-04	REV. DATE 75-04-27
APPROVED:		PREPARED BY:	

METRIC

SINGLE CRYSTAL QUARTZ FOR
SURFACE ACOUSTIC WAVE DEVICES

1. SCOPE

1.1 This specification establishes the requirements for quartz materials to be used in the fabrication of surface acoustic wave devices.

1.2 Classification. Quartz covered by this specification shall be of the forms and orientation shown in Table I.

Table I: Forms and Orientations of Quartz Crystal.

Identifying Number	Form	Orientation (See 3.2)
760781	Boule	As grown (See 3.2.1)
760781-10	Plate	ST-X
760781-11	Plate	YX
760781-100	Substrate	ST-X
760781-110	Substrate	YX

2. APPLICABLE DOCUMENTS

2.1 There are no applicable government documents.

STANDARD
GSG GSG
RELEASE

2.2 Other. The following document, of the issue in effect on date of invitation for bids, forms a part of this specification to the extent specified herein. In the event of a conflict between the referenced document and this specification, the contents of this specification shall govern.

Hughes Aircraft Company (GSG)

P81 Eulerian Angles

(Copies of GSG documents may be obtained from the Hughes Aircraft Company, P. O. Box 3310, Fullerton, CA. 92634.)

3. REQUIREMENTS

3.1 The quartz shall be a single, polarized crystal in the form of a boule, plate, or substrate that has been oriented, cut, and finished in accordance with the requirements herein (See 6.1).

3.2 Orientation.

3.2.1 Boules. The specified axis shall be within 2° of the major axis of the boule (see 6.1.1).

3.2.2 Plates and substrates. The crystalline axes (X Y Z) shall be oriented to the surface axes (X' Y' Z') of the plate or substrate (Figure 1) as determined by the applicable Eulerian angles (ϕ θ Ψ) specified in Table II. Eulerian angles are defined in Standard Design Drawing P81 (summary of the description given in Classical Mechanics by Herbert Goldstein).

3.2.2.1 Orientation identification. When the standard surface acoustic wave propagation direction is not the longest axis of the plate or substrate, the orientation shall be clearly identified on each plate or substrate.

Table II: Eulerian Angles for Orientation of Crystalline Structure

Identifying Number	Orientation	Eulerian Angles ϕ θ ψ (degrees) Tolerance $\pm 0.1°$
760781-10	ST-X	0, 132.75, 0
760781-11	YX	0, 90, 0
760781-100	ST-X	0, 132.75, 0
760781-110	YX	0, 90, 0

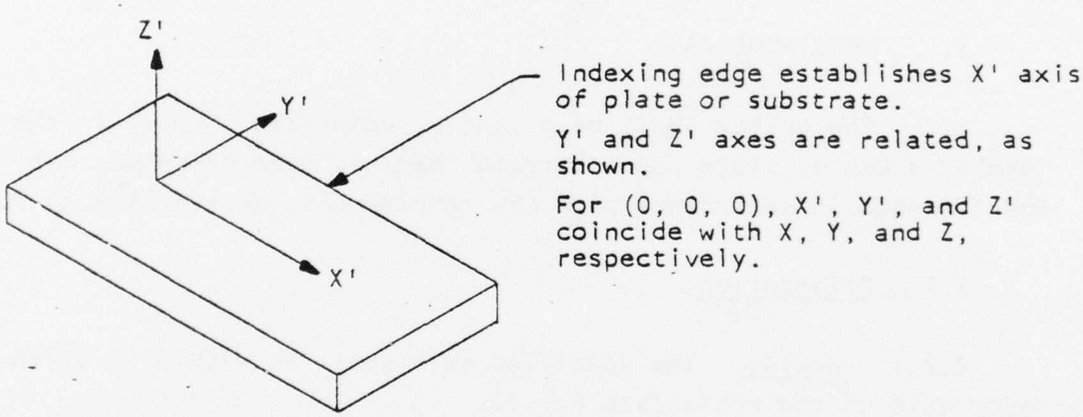


FIGURE 1: IDENTIFICATION OF SURFACE AXES FOR PLATES AND SUBSTRATES

3.3 Dimensions.

3.3.1 Boules. The length and diameter specified in the applicable purchase document for the boule are minimum dimensions. When the boule is ordered by weight, the weight specified on the applicable purchase document is the minimum acceptable net weight.

3.3.2 Plates. Plate dimensions are as specified in the applicable purchase document. Tolerances are as follows:

(a) Length and width or diameter values are minimum dimensions.

(b) Thickness is +0.5, -0 mm (+0.020, - 0.000 inches).

(c) Top and bottom surfaces shall be parallel within 0.25 mm (.01 inch).

3.3.3 Substrates. Substrate dimensions are as specified in the applicable purchase document. Tolerances are as follows:

(a) Length and width or diameter values are minimum dimensions.

(b) Thickness is $\pm$0.05 mm ($\pm$0.002 inch).

(c) Top and bottom surfaces shall be parallel within 0.002 mm per mm (0.002 inch per inch).

(d) The polished surface shall be flat within 0.08 wave per millimeter (2 waves per inch).

3.4 Surface Finish. Surface finish shall be as specified in Table III and as defined herein. 120 grit surface shall exhibit a finish at least equivalent to that obtained from a lapping operation using 120 grit carborundum. Polished surfaces shall be such that examination at 250 diameter magnification does not reveal scratches, nicks, pits, or other blemishes that will adversely affect the intended application.

Table III: Quartz Crystal Surface Finish

Ident Number	Material Form	Surface Finish
760781	Boule	As grown; if cut to rough shape, not to exceed surface roughness height of 6.3 µm (250 microinches).
760781-1X	Plate	As cut; not to exceed surface roughness height of 6.3 µm (250 microinches).
760781-1XX	Substrate	Top surface surface - polished Opposite surface - 120 Grit

3.5 Workmanship. The material shall be free of gross impurity, high strains or optical inhomogeneities. There shall be no cracks, blisters, bubbles, pits, inclusions or unspecified holes or notches as viewed in ordinary white light using the unaided eye. Evidence of chipping or protrusions on any edge or surface shall not extend more than 0.25 mm (0.010 inch) from the outside edges or surface nor more than 0.13 mm (0.005 inch) from a hole, notch, slot or other specified topographical feature.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection. Unless otherwise specified in the contract or purchase order, the supplier is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified, the supplier may utilize his own facilities or any commercial laboratory acceptable to the contracting activity. The contracting activity reserves the right to perform any of the inspections set forth in this specification where such inspections are deemed necessary to assure supplies and services conform to prescribed requirements.

4.2 Acceptance tests. Acceptance tests shall consist of the following:

Determination of quantity of pieces.

NOTE: Receiving inspection activity is prohibited from opening packages as material is easily contaminated by handling.

4.3 Test procedures. The following procedures shall be used by the procuring agency to ascertain compliance with the requirements of this specification. Failure to meet the requirements when tested by these methods will constitute failure to qualify and be cause for rejection of the shipment.

4.3.1 Dimensions. Compliance to dimensional requirements specified in the purchase document and tolerances specified herein shall be established using standard measuring devices of the appropriate precision.

4.3.2 Until the technical details of measuring the parameters associated with the requirements of section 3.2 are suitably developed, compliance with these requirements will be established by engineering.

4.3.3 Workmanship. The pieces shall be examined visually up to 250X magnification to determine compliance to the requirements of 3.4 and 3.5.

5. PREPARATION FOR DELIVERY

5.1 Packaging and packing. Packaging and packing shall conform to good commercial practice and shall be such as to protect the material from contamination and mechanical damage or any change of composition and form during shipment and prolonged storage. Packing shall be so arranged as to facilitate inventory audit by weighing or counting.

5.2 Package marking. Marking shall include but not necessarily be limited to the following:

760781 (and applicable dash numbers, if any)
Manufacturer's name or code
Manufacturer's material designation
Lot or batch identification
Quantity
Contract or procurement number
A prominent statement on outer packaging:
"Do Not Open For Inspection Unless Ultimate User Is Present."

5.3 All marking shall be clearly legibly, contrasting in color and shall not be obliterated by normal handling and storage.

6. NOTES

6.1 Ordering data.

6.1.1 Boule. Procurement documents shall specify:

(a) Boule
(b) 760781
(c) Minimum length and diameter, or weight of boule.
(d) Major axis of the boule.
(e) Title, number, and date of this specification.
(f) Special instructions for packaging (See 5.).
(g) Location of reference flat, if required.

6.1.2 Plates and substrates. Procurement documents shall specify:

(a) Title, number, and date of this specification.
(b) Material identification number, including applicable dash number.
(c) Plate or substrate.
(d) Material thickness.
(e) Minimum diameter or length and width of plate or substrate.
(f) Special instructions for packaging (See 5.).

7. QUALIFIED SOURCE

7.1 Procurement under this specification is limited to the product shown below:

Material	Manufacturer's Designation	Manufacturer's Name and Address
760781	Single Crystal Quartz, Boule	Valpey-Fisher 75 South Street Hopkinton, MA. 01748 Phone: (617) 435-6831 FSCM: 21821
760781-10	Single Crystal Quartz, Plate ST-X	Local Source Wolf Engineering P. O. Box 2311 Newport Beach, CA. 92663 Phone: (714) 646-7214
760781-11	Single Crystal Quartz, Plate YX	
760781-100	Single Crystal Quartz, Substrate ST-X	Toyo Communication Equipment Co., Ltd. Toyo Bldg., Jingumae 6-12-20 Shibuya-ku, Tokyo, Japan Telex: 02423001 TOYOCO J Local Source
760781-110	Single Crystal Quartz, Substrate YX	IHP, Inc. 16871 Noyes Avenue Irvine, CA. 92714 Phone: (714) 546-4651

HUGHES

HUGHES AIRCRAFT COMPANY

HUGHES AIRCRAFT COMPANY
GROUND SYSTEMS GROUP
FULLERTON, CALIFORNIA

CODE IDENT NO. 05869

MATERIALS AND PROCESSES
CHANGE NOTICE

SPEC 760716 REV C [X] AMEND ____ [ ]

STATUS ACTIVE [X] INACTIVE [ ]

LITHIUM NIOBATE FOR SURFACE ACOUSTIC WAVE DEVICES

Specification 760716, Revision B, has been revised as follows:

Revision C

1. Document designated METRIC.
2. Corrected designation of orientation from 41.5 X to 41.5 Z', X.
3. Added 41.5 Z', X plate and substrate to approved sources.
4. Minor editorial and typographical errors corrected.

DATE: 27 April 1978 ENGINEER: [signature]

[signature] APPROVED: [signature]

GROUND SYSTEMS MATERIAL SPECIFICATION

APPROVED - MATERIALS & PROCESSES	HUGHES AIRCRAFT COMPANY GROUND SYSTEMS GROUP FULLERTON, CALIF. 92634 CODE IDENT. NO. 05869	760716	REV:
APPROVED: DW Korbyn		ISSUE DATE 78-06-03	REV. DATE 78-04-
APPROVED: [illegible]		PREPARED BY: Dowell	
			METRIC

LITHIUM NIOBATE FOR SURFACE

ACOUSTIC WAVE DEVICES

1. SCOPE.

1.1 This specification establishes the requirements for Lithium Niobate materials to be used in the fabrication of surface acoustic wave devices.

1.2 Classification. Lithium Niobate covered by this specification shall be of the forms and orientation shown in Table I.

Table I: Forms and Orientations of Lithium Niobate

Identifying Number	Form	Orientation (See 3.2)
760716	Boule	As grown (See 3.2.1)
760716-10	Plate	YZ
760716-11	Plate	41.5 Z', X
760716-100	Substrate	YZ
760716-110	Substrate	41.5 Z', X

2. APPLICABLE DOCUMENTS

2.1 There are no applicable government documents.

2.2 Other. The following document, of the issue in effect on date of invitation for bids, forms a part of this specification to the extent specified herein. In the event of a conflict between the referenced document and this specification, the contents of this specification shall govern.

Hughes Aircraft Company (GSG)

P81 Eulerian Angles

(Copies of GSG documents may be obtained from the Hughes Aircraft Company, P. O. Box 3310, Fullerton, CA. 92634.)

3. REQUIREMENTS

3.1 The Lithium Niobate shall be a single, polarized crystal in the form of a boule, plate, or substrate that has been oriented, cut, and finished in accordance with the requirements herein (See 6.1)

3.2 Orientation.

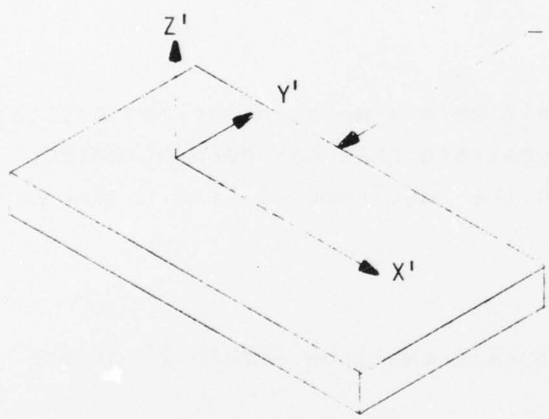
3.2.1 Boules. The specified axis shall be within 2° of the major axis of the boule (See 6.1.1).

3.2.2 Plates and substrates. The crystaline axes (X Y Z) shall be oriented to the surface axes (X' Y' Z') of the plate or substrate (Figure 1) as determined by the applicable Eulerian angles ($\phi - \psi$) specified in Table II. Eulerian angles are defined in Standard Design Drawing P81 (summary of the description given in Classical Mechanics by Herbert Goldstein).

3.2.2.1 Orientation identification. When the standard surface acoustic wave propagation direction is not the longest axis of the plate or substrate, the orientation shall be clearly identified on each plate or substrate.

Table II: Eulerian Angles for Orientation of Crystaline Structure

Identifying Number	Orientation	Eulerian Angles ϕ θ Ψ (degrees) Tolerance $\pm 0.1°$
760716-10	YZ	0, 90, 90
760716-11	41.5 Z', X	0, 41.5, 0
760716-100	YZ	0, 90, 90
760716-110	41.5 Z', X	0, 41.5, 0



Indexing edge establishes X' axis of plate or substrate.

Y' and Z' axes are related, as shown.

For (0, 0, 0) the X', Y' and Z' axes coincide with the X, Y, and Z axes respectively.

FIGURE I. IDENTIFICATION OF SURFACE AXES FOR PLATES AND SUBSTRATES

3.3 Dimensions.

3.3.1 Boules. The length and diameter specified in the applicable purchase document for the boule are minimum dimensions. When the boule is ordered by weight, the weight specified on the applicable purchase document is the minimum acceptable net weight.

3.3.2 Plates. Plate dimensions are as specified in the applicable purchase document. Tolerances are as follows:

(a) Length and width or diameter values are minimum dimensions.

(b) Thickness is +0.5, -0 mm (+0.020, -0.000 inches).

(c) Top and bottom surfaces shall be parallel within 1.25 mm (.01 inch).

3.3.3 Substrates. Substrate dimensions are as specified in the applicable purchase document. Tolerances are as follows:

(a) Length and width or diameter values are minimum dimensions.

(b) Thickness is ±0.05 mm (±0.002 inch).

(c) Top and bottom surfaces shall be parallel within 0.002 per mm (0.002 inch per inch).

(d) The polished surface shall be flat within 0.08 wave per millimeter (2 waves per inch).

3.4 Surface finish. Surface finish shall be as specified in Table III and as defined herein. 120 grit surface shall exhibit a finish at least equivalent to that obtained from a lapping operation using 120 grit carborundum. Polished surfaces shall be such that examination at 250 diameter magnification does not reveal scratches, nicks, pits, or other blemishes that will adversely affect the intended application.

Table III: Lithium Niobate Crystal Surface Finish

Identifying Number	Material Form	Surface Finish
760716	Boule	As grown; if cut to rough shape, not to exceed surface roughness height of 6.3 µm (250 microinches).
760716-1X	Plate	As cut; not to exceed surface roughness height of 6.3 µm (250 microinches).
760716-1XX	Substrate	Top surface -polished Opposite surface - 120 Grit

3.5 Poling. The boule shall be electrically poled to the extent that an iso-gyre inspection shall clearly show a cross pattern.

3.6 Workmanship. The material shall be free of gross impurity, high strains or optical inhomogeneities. There shall be no cracks, blisters, bubbles, pits, inclusions or unspecified holes or notches as viewed in ordinary white light using the unaided eye. Evidence of chipping or protrusions on any edge or surface shall not extend more than 0.25 mm (0.010 inch) from the outside edges or surface nor more than 0.13 mm (0.005 inch) from a hole, notch, slot or other specified topographical feature.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection. Unless otherwise specified in the contract or purchase order, the supplier is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified, the supplier may utilize his own facilities or any commercial laboratory acceptable to the contracting activity. The contracting activity reserves the right to perform any of the inspections set forth in this specification where such inspections are deemed necessary to assure supplies and services conform to prescribed requirements.

4.2 Acceptance tests. Acceptance tests shall consist of the following:

Determination of quantity of pieces.

NOTE: Receiving inspection activity is prohibited from opening packages as material is easily contaminated by handling.

4.3 Test procedures. The following procedures shall be used by the procuring agency to ascertain compliance with the requirements of this specification. Failure to meet the requirements when tested by these methods will constitute failure to qualify and be cause for rejection of the shipment.

AD-A064 197 HUGHES AIRCRAFT CO FULLERTON CALIF GROUND SYSTEMS GROUP F/G 9/5
PHOTOLITHOGRAPHIC TECHNIQUES FOR SURFACE ACOUSTIC WAVE (SAW) DE--ETC(U)
DEC 78 A W DOZIER DAAB07-75-C-0044
UNCLASSIFIED FR-79-12-40-VOL-1 DELET-TR-75-0044-F-VOL-1 NL

2 OF 4
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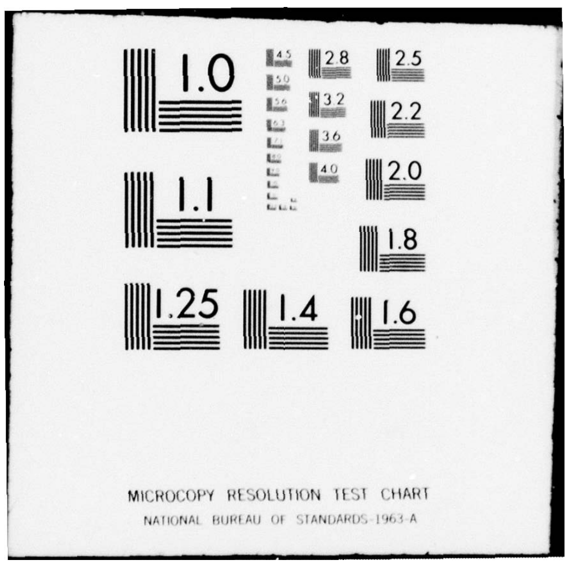
A064197


1.0
1.1
1.25
1.4
1.6
1.8
2.0
2.2
2.5
2.8
3.2
3.6
4.0
4.5
5.0
5.6
MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

4.3.1 Dimensions. Compliance to dimensional requirements specified in the purchase document and tolerances specified herein shall be established using standard measuring devices of the appropriate precision.

4.3.2 Until the technical details of measuring the parameters associated with the requirements of sections 3.2 and 3.5 are suitably developed, compliance with these requirements will be established by engineering.

4.3.3 Workmanship. The pieces shall be examined visually up to 250X magnification to determine compliance to the requirements of 3.4 and 3.6.

5. PREPARATION FOR DELIVERY

5.1 Packaging and packing. Packaging and packing shall conform to good commercial practice and shall be such as to protect the material from contamination and mechanical damage or any change of composition and form during shipment and prolonged storage. Packing shall be so arranged as to facilitate inventory audit by weighing or counting.

5.2 Package marking. Marking shall include but not necessarily be limited to the following:

760716 (and applicable dash numbers, if any)
Manufacturer's name or code
Manufacturer's material designation
Lot or batch identification
Quantity
Contract or procurement number
A prominent statement on outer packaging:
"Do Not Open For Inspection Unless Ultimate User Is Present."
An explanation of orientation indicators (See 3.2.2.1).

5.3 All marking shall be clearly legible, contrasting in color and shall not be obliterated by normal handling and storage.

6. NOTES

6.1 Ordering data.

6.1.1 Boule. Procurement documents shall specify:

(a) Boule
(b) 760716
(c) Minimum length and diameter, or weight of boule.
(d) Major axis of the boule.
(e) Title, number, and date of this specification.
(f) Special instructions for packaging (See 5.).
(g) Location of reference flat, if required.

6.1.2 Plates and substrates. Procurement documents shall specify:

(a) Title, number and date of this specification.
(b) Material identification number, including applicable dash number.
(c) Plate or substrate.
(d) Material thickness.
(e) Minimum diameter or length and width of plate or substrate.
(f) Special instructions for packaging (See 5.).

7. QUALIFIED SOURCE

7.1 Procurement under this specification is limited to the product shown below:

Material	Manufacturer's Designation	Manufacturer's Name and Address
760716	Lithium Niobate Boule, transducer grade.	Crystal Technology, Inc. 2510 Old Middlefield Way Mountain View, CA. 94043 Phone (415) 961-9311 FSCM: 50559
760716-10	Lithium Niobate Plate, transducer grade. YZ	
760716-11	Lithium Niobate Plate, 41.5 Z', X	
760716-100	Lithium Niobate Substrate, YZ	Union Carbide Corporation Electronics Division 3615 Del Amo Blvd. Torrance, CA. Phone: (213) 371-5521
760716-110	Lithium Niobate Substrate, 41.5 Z', X	

DRAWING (DWG) AND PARTS LIST (PL)

REVISIONS			
LTR	DESCRIPTION	DATE	APPROVED

EULERIAN ANGLES ARE THREE SUCCESSIVE ANGLES OF ROTATION USED TO ORIENT CRYSTALINE STRUCTURES RELATIVE TO PLATE AND SUBSTRATE SURFACES. THEY ARE APPLIED AS FOLLOWS:

(A) FIRST THE INITIAL SYSTEM OF AXES XYZ ARE ROTATED COUNTER-CLOCKWISE ABOUT THE Z AXIS BY AN ANGLE ϕ (FIGURE 1). THE RESULTING COORDINATE SYSTEM IS LABELLED THE $\xi\eta\zeta$ AXES.

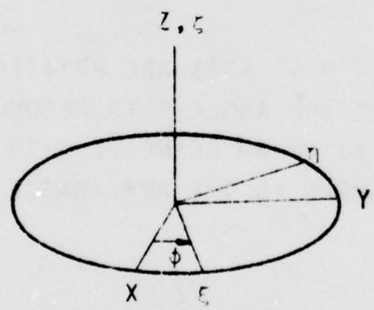


FIGURE 1. FIRST ROTATION

STANDARD DESIGN DRAWING

REV STATUS OF SHEETS	SHEET	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
	REV	-	-														

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES AND PER ANSI Y14.5	CONTRACT: NONE	HUGHES	HUGHES AIRCRAFT COMPANY FULLERTON, CALIFORNIA			
	DR H. Schulz 78-03-30	EULERIAN ANGLES				
	CHK W. Voigt 78-03-30					
.XXX ±.010 .XX ±.03	APPD R. Burns 78-04-17	SIZE C	FSCM NO. 05869	DWG NO. P81		REV -
ANGLES ±0.5°	3-1	SCALE NONE		SHEET 1 OF 2		

(B) NEXT, THE INTERMEDIATE AXES ARE ROTATED COUNTERCLOCKWISE ABOUT THE ξ AXIS BY AN ANGLE θ (FIGURE 2). THIS NEW SET OF AXES IS LABELLED $\xi'\eta'\zeta'$.

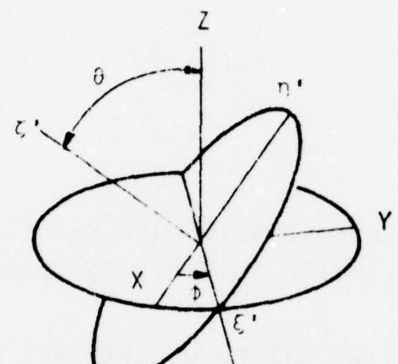


FIGURE 2. SECOND ROTATION

(C) FINALLY, THE $\xi'\eta'\zeta'$ AXES ARE ROTATED COUNTERCLOCKWISE ABOUT THE ζ' AXIS BY THE ANGLE ψ TO PRODUCE THE DESIRED X'Y'Z' AXES (FIGURE 3) WHICH COINCIDE WITH THE PLATE OR SUBSTRATE SURFACES AS SHOWN IN THE APPLICABLE MATERIAL SPECIFICATION.

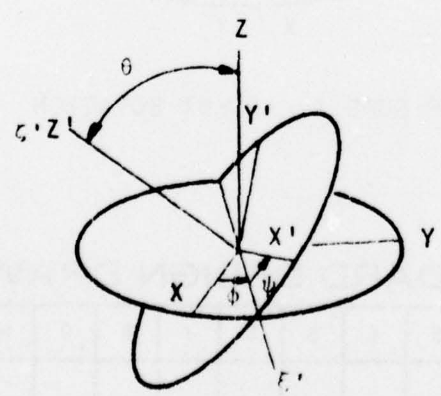


FIGURE 3. THIRD ROTATION

HUGHES AIRCRAFT COMPANY FULLERTON, CALIFORNIA	CONTRACT:			
DR W. Schulz 78-03-30	SIZE A	FSCM NO. 05869	DWG NO. P81	REV -
ISSUED	SCALE 3-2		SHEET 2	

REVISIONS			
LTR	DESCRIPTION	DATE	APPROVED
-	PRODUCTION RELEASE	77-11-10	[illegible]

REV STATUS OF SHEETS	SHEET	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
	REV	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES AND PER ANSI Y14.5	CONTRACT: DAAB07-75-C-0044	HUGHES — HUGHES AIRCRAFT COMPANY FULLERTON, CALIFORNIA
	DR K. Burns 77-09-28	DELAY LINE, SURFACE ACOUSTIC WAVE - DESIGN/PERFORMANCE SPECIFICATION
.XXX	CHK [illegible] 77-11-09	
.XX	APPD [illegible] 77-11-09	SIZE A — FSCM NO. 05869 — DWG NO. 1950512-600 — REV -
ANGLES	ISSUED 3-3	SCALE NONE — WT — SHEET 1 OF 16

D14-338 GS 1/77

ELECTRONICS COMMAND
TECHNICAL REQUIREMENTS

SCS-476

PHOTOLITHOGRAPHICALLY PRODUCED ACOUSTIC SURFACE WAVE PULSE COMPRESSION, BAND-PASS AND PHASE-CODED FILTERS

1. SCOPE

1.1 Scope. This specification covers the requirements for photolithographic and batch fabrication techniques necessary for the low-cost production of acoustic, surface-wave pulse compression, band-pass, and phase-coded filters.

2. APPLICABLE DOCUMENTS

2.1 The following documents, of the issue in effect on date of invitation for bids or request for proposal, form a part of this specification to the extent specified herein.

SPECIFICATIONS

MILITARY

MIL-C-39012	Connector, Coaxial, Radio Frequency, General Specification For.

STANDARDS

MILITARY

MIL-STD-105	Sampling Procedures and Tables for Inspection by Attributes.
MIL-STD-130	Identification Marking of US Military Property.
MIL-STD-202	Test Methods for Electronic and Electrical Component Parts.
MIL-STD-883	Test Methods and Procedures for Microelectronics.

(Copies of specifications, standards, drawings, and publications required by suppliers in connection with specific procurement functions should be obtained from the procuring activity or as directed by the contracting officer. Both title and identifying number or symbol should be stipulated when requesting copies.)

3. REQUIREMENTS

3.1 General Description. The filters shall be photolithographically fabricated on lithium niobate or ST quartz substrates.

3.2 Processing.

3.2.1 Metallization. An aluminum film shall be deposited on the piezoelectric substrates using high vacuum or radio frequency sputtering systems. The resistivity shall be less than 0.5 ohms per square.

3.2.1.1 Uniformity of metallization. The absolute thickness of the aluminum film may vary between 1000 and 2000 angstrom (A^{o}); the uniformity of the thickness shall be controlled to $\pm$ 5 percent.

3.2.1.2 Adhesion of metallic film. The adhesion of the aluminum film to the substrate shall remain intact on the surface of the substrate (see 4.6.2).

3.2.2 Photoresist application. Photoresist shall be applied to the lithium niobate and ST quartz substrates resulting in a thin uniform coating capable of resolving 2 micron lines.

3.2.3 Photolithographic processing. Contact printing (etching), "lift-off" or "wet contact" printing techniques shall be used, whereby photomasks are applied over the photoresist.

3.2.4 Visual inspection.

3.2.4.1 Wafer. Circuits on the undiced wafer shall be checked using an approved prototype comparison standard to check the sameness of each circuit pattern using a minimum 250X magnification. A minimum of one circuit per wafer or substrate should be examined. A comparison standard is a wafer whose devices meet the specified design and have passed all the electrical tests. This comparison standard will be used as a reference model in order to cull devices with obvious defects in the geometry.

3.2.4.2 Filter package (device). The circuit chip shall be examined after placement in package (without cover) for broken wire bonds, dirt, scratches or other circuit imperfections under 20X magnification.

3.2.5 Dicing of wafer into circuit chips. When required to separate the multiple identical circuits fabricated on the same wafer, a diamond-tipped precision cutting tool shall be used.

3.2.6 Wire bonding. Wire bonding techniques shall be performed so that reliable electrical connections between the surface acoustic wave circuit and the package connectors are made.

3.2.7 Device packaging. Packaging and sealing techniques shall be used so that the resultant hermetically sealed filters shall be capable of meeting all the environmental requirements as specified herein.

3.3 Classes of devices. The required filter type devices are identified as follows:

Devices	Substrate Materials	Center Frequency
a. Linear FM Pulse Compression Filter	ST Quartz	150 MHz
	Lithium Niobate	150 MHz
b. Linear Phase Band-Pass Filter	ST Quartz	100 MHz
	Lithium Niobate	150 MHz
c. Biphase-Coded Tapped Delay Line Filter	ST Quartz	100 MHz
	ST Quartz	200 MHz

3.3.1 Linear FM pulse compression filters. In-line configuration shall be used with internal weighting for sidelobe suppression. Conjugate matched filter pairs shall be fabricated from each substrate material and used to demonstrate pulse compression in each case.

3.3.2 Linear-phase band-pass filters. Multistrip couplers shall be used on lithium niobate to couple the two apodized transducers which effect the weighted filter response.

3.3.3 Biphase-coded tapped delay line filters. Phase-coded tapped delay line filters with center frequencies of 100 and 200 MHz shall use uniform aperture for the phase-coded array. Conjugate matched filter pairs shall be fabricated and used to demonstrate autocorrelation.

3.4 Number of circuit chips per wafer.

3.4.1 Linear-FM pulse compression filters.

3.4.1.1 ST quartz. At least 10 circuit chips shall be fabricated on a single piezoelectric wafer.

3.4.1.2 Lithium niobate. At least 10 circuit chips shall be fabricated on a single piezoelectric wafer.

3.4.2 Linear-phase band-pass filters.

3.4.2.1 ST quartz. At least 15 circuit chips shall be fabricated on a single piezoelectric wafer.

3.4.2.2 Lithium niobate. At least 15 circuit chips shall be fabricated on a single piezoelectric wafer

3.4.3 Biphase-coded tapped delay line filters.

3.4.3.1 At least 7 circuit chips shall be fabricated on a single piezoelectric ST quartz wafer.

3.5 Construction.

3.5.1 Connections (external). The basic filter shall employ two or three parts, depending on the type of filter device with connectors or strip leads. (The precise location should be finalized prior to the confirmatory sample phase.)

3.5.1.1 Connectors. When connectors are used with these filter devices, they shall be series SMA and shall conform to the requirements of MIL-C-39012.

3.5.1.2 Strip leads (lead integrity). When strip leads are used, they shall show no physical or mechanical damage when tested (see 4.6.4.2).

3.5.2 Connections (internal), wire bonding (lead integrity). Gold wire connections of two mil diameter and minimum length, shall show no evidence of loosening or rupturing from the wire bond connection (see 4.6.4.1).

3.5.3 Dimensions. The crystal and package size shall meet the maximum dimensions in inches specified in Table I (see 4.6.3).

Table I. Dimensions.

Classes of Devices	Substrate Material	Max. Circuit Chip Size Substrate (Inches) L W T	Max. Filter Package Size (Inches) L W T
Linear-FM Pulse Type Compression Filters	ST Quartz	1.00 x 0.200 x 0.050	2.0 x 1.0 x 0.50
	Lithium Niobate		
Linear Phase Band Pass Filters	ST Quartz	1.00 x 0.200 x 0.050	2.0 x 1.0 x 0.50
	Lithium Niobate		
Biphase-coded Tapped Delay Lines	ST Quartz (100 MHz)	2.20 x 0.200 x 0.050	3.0 x 1.0 x 0.50
	ST Quartz (200 MHz)	2.2 x 0.200 x 0.050	3.0 x 1.0 x 0.50

3.6 Hermetic seal. Each filter shall be back-filled with an inert gas and shall show no evidence of leakage (see 4.6.5).

3.7 Thermal shock. Each filter shall show no evidence of mechanical or physical damage and shall exhibit no short circuits (see 4.6.6).

3.8 Solderability (strip leads) (when applicable). Strip leads shall be solderable (see 4.6.7).

3.9 Short circuit and open circuit tests. All chips and filter circuit devices, as applicable, shall be checked for no shorted circuits. A continuity check shall be made to determine that no open circuits exist between the external connection and the surface wave circuit.

3.10 Electrical characteristics. Filters shall meet the electrical characteristics and tolerances as specified (see 4.6.9).

3.10.1 Center frequency of operation.

3.10.1.1 Linear FM pulse compression filters.

a. ST Quartz: 150 MHz ± 3 MHz.
b. Lithium Niobate: 150 MHz ± 3 MHz.

3.10.1.2 Linear-phase band-pass filters.

a. ST Quartz: 100 MHz ± 2 MHz.
b. Lithium Niobate: 150 MHz ± 3 MHz.

3.10.1.3 Biphase-coded tapped delay line filters.

a. ST Quartz: 100 MHz ± 2 MHz.
b. ST Quartz: 200 MHz ± 4 MHz.

3.10.2 Bandwidth (3db).

3.10.2.1 Linear FM pulse compression filters.

a. ST Quartz: 50 MHz ± 1 MHz.
b. Lithium Niobate: 50 MHz ± 1 MHz.

3.10.2.2 Linear-phase band-pass filters.

a. ST Quartz: 2 MHz ± 40 MHz.
b. Lithium Niobate: 30 MHz ± 0.6 MHz.

3.10.2.3 Biphase-coded tapped delay line filters.

a. ST Quartz: 10 MHz ± 0.2 MHz (100 MHz) center frequency.
b. ST Quartz: 10 MHz ± 0.2 MHz (200 MHz) center frequency.

3.10.3 Time-delay.

3.10.3.1 Linear FM pulse compression filters (dispersive delay).

a. ST Quartz: 2 microsec ± 0.02 microsec.
b. Lithium Niobate: 2 microsec ± 0.01 microsec.

3.10.3.2 Linear-phase band-pass filters (nondispersive delay).

a. ST Quartz: 2 microsec $\pm$ 0.01 microsec.
b. Lithium Niobate: 2 microsec $\pm$ 0.01 microsec.

3.10.3.3 Biphase-coded tapped delay line filters.

a. ST Quartz: 12.7 microsec (100 MHz) center frequency.
b. ST Quartz: 12.7 microsec (200 MHz) center frequency.

3.10.4 Time-bandwidth product.

3.10.4.1 Linear FM pulse compression filters.

a. ST Quartz: 100:1
b. Lithium Niobate: 100:1

3.10.4.2 Linear-phase band-pass filters.

a. ST Quartz: 4:1
b. Lithium Niobate: 60:1

3.10.4.3 Biphase-coded tapped delay line filters.

a. ST Quartz: 127:1 (100 MHz) center frequency.
b. ST Quartz: 127:1 (200 MHz) center frequency.

3.10.5 Insertion loss. (Insertion loss is to be measured by CW)

3.10.5.1 Linear FM pulse compression filters.

a. ST Quartz: 55db $\pm$ 5 db.
b. Lithium Niobate: 30db $\pm$ 3db.

3.10.5.2 Linear-phase band-pass filters.

a. ST Quartz: 20db $\pm$ 2db.
b. Lithium Niobate: 15db $\pm$ 1.5db.

3.10.5.3 Biphase-coded tapped delay line filters.

a. ST Quartz: 30db $\pm$ 3db (100 MHz) center frequency.
b. ST Quartz: 30db $\pm$ 3db (200 MHz) center frequency.

3.10.6 Time-sidelobe suppression level.

3.10.6.1 Pulse compression filters.

a. ST Quartz: $\geq$ -25db.
b. Lithium Niobate: $\geq$-25db.

3.10.6.2 Linear-phase band-pass filters.

a. ST Quartz: $\geq$ -35db.
b. Lithium Niobate: $\geq$ -35db.

3.10.6.3 Biphase-coded tapped delay line filters.

a. ST Quartz: $\geq$ -19db (100 MHz) center frequency.
b. ST Quartz: $\geq$ -19db (200 MHz) center frequency.

3.10.7 Feedthrough suppression. The feedthrough suppression shall be greater than -50db for all types of filters. This shall be relative to the Output Signal Level.

3.10.8 Spurious echo suppression. The spurious echo suppression shall be greater than -35db for all types of filters. Spurious echo refers to the double and triple transit phenomena.

3.10.9 Voltage standing wave ratio (VSWR). The VSWR shall be less than 1.5:1 for all types of filters over the operating band with a 50 ohm impedance (Z_o).

3.11 High temperature storage. Filters shall show no evidence of physical or mechanical damage and no electrical short circuits after subjection to a temperature of 75°C (see 4.6.10 and 4.6.8).

3.12 Shock (specified pulse). Filters shall show no evidence of mechanical or physical damage and no electrical short circuits (see 4.6.11 and 4.6.8).

3.13 Vibration (low frequency). Filters shall show no evidence of mechanical or physical damage and no electrical short circuits (see 4.6.12 and 4.6.8).

3.14 Moisture resistance. Filters shall show no evidence of mechanical or physical damage and no short circuits. All of the electrical characteristics (final) shall be met in accordance with the limits provided in the government approved contractor's plan (see 4.6.13 and 4.6.8).

3.15 Life. After 500 hours of life, the filters shall show no evidence of mechanical or physical damage; and shall meet all of the electrical characteristics (final) in accordance with the limits provided in the government approved contractor's plan (see 4.6.14).

3.16 Marking. All markings shall remain legible throughout processing and testing in accordance with MIL-STD-130.

3.16.1 Wafer. Identification shall be provided on each chip on the substrate to indicate the manufacturer; crystal type; batch or lot; crystal cut and orientation.

3.16.2 Filter. Identification of the type of device along with a descriptive identifying number indicating operating frequency and bandwidth.

3.17 Workmanship. Chips and filters shall be processed in such a manner as to be uniform in quality and shall be free from cracks or other defects that will affect life, serviceability and appearance.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection. The contractor is responsible for the performance of all inspections specified herein. The contractor may utilize his own facilities or any commercial laboratory acceptable to the government. Tests shall be performed under the supervision of a government representative. Inspection records of the examinations and tests shall be kept complete and available to the government as specified in the contract.

4.2 Classification of inspection. Inspection shall be classified as follows:

a. First article inspection (does not include preparation for delivery) (see 4.4).
b. Quality conformance inspection.

4.3 Inspection condition. Unless otherwise specified herein, all inspections shall be in accordance with the test conditions specified in general requirement of MIL-STD-202.

4.4 First article inspections. This inspection shall consist of all the tests in tables III and IV including the use of the contractor submitted government-approved plan on test methods and procedures for determining the electrical characteristics and the electrical characterisitcs final limits. No failures in excess of those indicated shall be permitted.

4.4.1 Sample.

4.4.1.1 Wafers. (See table II.)

4.4.1.2 Circuit chips. The wafers shall be diced into discrete circuit chips with the exclusion of one wafer for each type of substrate and shall be submitted for inspection as indicated in table II.

4.4.2 Test routine.

4.4.2.1 Wafer submission. Sample units shall be subjected to the inspection specified in table III, in the order shown prior to dicing into discrete circuit devices. Ten (10) each of the first four categories in table II shall be tested and seven (7) each of the last two categories (ST Quartz 100 and 200 MHz, respectively). There shall be no failures.

4.4.2.2 Circuit devices. Eighty-four (84) operable filter circuit devices shall be submitted to the inspections specified in table IV, in the order shown. Twelve sample units shall be used for group II inspection only. The remaining units shall be subjected to group I inspection and subdivided into the remaining groups for their particular examination or test. Forty-two sample units of each substrate material (100 MHZ and 200 MHZ) of the operable biphase-coded tapped delay line filter circuit devices shall be submitted to the inspections specified in Table IV, in the order shown, using 36 sample units for group I; 6 sample units for group II; 9 sample units for groups III and IV; 6 sample units for group V, and 12 sample units for group VI. The number of defects shall remain as indicated for each group excluding group VI, where only 1 defect shall be allowed.

Table II. Class of devices with minimum number of wafers, circuits per wafer and total number of operable filter circuit devices.

Class of devices	Minimum Nr. of wafers	Minimum Nr. of circuits per wafer	Operable filter circuit devices
Linear FM pulse compression filters	10-ST Quartz	10	84
	10-Lithium Niobate	10	84
Linear band-pass filters	10-ST Quartz	15	84
	10-Lithium Niobate	15	84
Biphase-coded tapped delay line filters	7-ST Quartz (freq 100 MHz)	7	42 } 84
	7-ST Quartz (freq 200 MHz)	7	42

Table III. First article inspection of each type of wafer.

Examination or test	Requirement paragraph	Test paragraph
Marking	3.16.1	
Visual check (using a standard for reference under magnification) (250X)	3.2.4.1 3.17	4.6.1.1
Adhesion of metallic film	3.2.1.2	4.6.2
Short circuit	3.9	4.6.8

Table IV. First article inspection of each class of filter devices (circuit devices).

Examination or test	Requirement paragraph	Test paragraph	Number of Samples	Number of Defects
Group I				
Visual check (20X magnification)	3.2.4.2 3.17	4.6.1.2	72	0
Marking	3.16.2			
Dimensions	3.5.3	4.6.3		
Strip lead (lead integrity)	3.5.1.2	4.6.4.2		
Internal wire bonding (lead integrity)	3.5.2	4.6.4.1		
Electrical characteristics	3.10	4.6.9		
Group II				
Solderability (when applicable)	3.8	4.6.7	12	0
Group III				
High temperature storage	3.11	4.6.10	18	0
Electrical characteristics	3.10	4.6.9		
Center frequency	3.10.1 thru 3.10.1.3, incl.			
Insertion loss	3.10.5 thru 3.10.5.3, incl.			
Group IV				
Life	3.15	4.6.14	18	1
Short circuit test	3.9	4.6.8		
Electrical characteristics (Final)	3.10	4.6.9		
Group V				
Hermetic seal	3.6	4.6.5	12	0
Short circuit test	3.9	4.6.8		
Group VI				
Vibration	3.13	4.6.12	24	2
Short circuit test	3.9	4.6.8		
Shock	3.12	4.6.11		
Short circuit test	3.9	4.6.8		
Thermal shock (10 cycles)	3.7	4.6.6		
Short circuit test	3.9	4.6.8		
Moisture resistance	3.14	4.6.13		
Short circuit test	3.9	4.6.8		
Electrical characteristics (Final)	3.10	4.6.9		

4.4.3 Defectives.

4.4.3.1 Wafers. No defects shall be allowed in table III; any defects shall be cause for refusal to grant first article inspection approval.

4.4.3.2 Filter circuit devices. Defects in excess of those allowed in table IV shall be cause for refusal to grant first article inspection approval.

4.5 Quality conformance inspection.

4.5.1 Inspection of product for delivery. Inspection of products for delivery shall consist of groups A, B and C inspection.

4.5.1.1 Inspection lot. An inspection lot shall be as specified in MIL-STD-105 and applies to each of the six types of wafers or filter circuit devices, as applicable.

4.5.1.2 Group A inspection. Group A inspection shall consist of the examinations and tests in table V in the order shown. Subgroup I examination and tests are on wafers and subgroup II on the filter circuit devices.

Table V. Group A inspection.

Examination or test	Requirement paragraph	Method paragraph
Subgroup I		
Marking	3.16.1	
Adhesion of metallic film	3.2.1.2	4.6.2
Short circuit	3.9	4.6.8
Visual Inspection	3.2.4.1, 3.17	4.6.1
Subgroup II		
Visual (magnification 20X)	3.2.4.2, 3.17	4.6.1.2
Marking	3.16.2	
Hermetic seal	3.6	4.6.5
Strip lead (lead integrity)	3.5.1.2	4.6.4.2
Internal wire bonding (lead integrity)	3.5.2	4.6.4.1

4.5.1.2.1 Sampling plan. 100 percent inspection shall be performed on subgroup I on the wafers which shall then be diced into discrete circuits; and subgroup II inspection shall be performed using 100 percent inspection.

4.5.1.2.2 Rejected samples. If during the 100 percent inspection of subgroup I, screening indicated that over 30 percent of the total filter circuit devices on all wafers (undiced) be discarded, the lot (wafers) shall be rejected.

4.5.1.3 Group B Inspection. Group B inspection shall consist of the tests specified in table VI, in the order shown and shall be made on sample units which have been subjected to and have passed group A, subgroup II inspection.

Table VI. Group B inspection.

Examination or test	Requirement paragraph	Method paragraph
Eletrical characteristics		
Center frequency of operation	3.10.1, 3.10.1.1, 3.10.1.2, 3.10.1.3	4.6.9
Bandwidth	3.10.2, 3.10.2.1, 3.10.2.2, 3.10.2.3	4.6.9
Time delay	3.10.3, 3.10.3.1, 3.10.3.2, 3.10.3.3	4.6.9
Time-bandwidth product	3.10.4, 3.10.4.1, 3.10.4.2, 3.10.4.3	4.6.9
Insertion loss	3.10.5, 3.10.5.1, 3.10.5.2, 3.10.5.3	4.6.9
Time-sidelobe suppression level	3.10.6, 3.10.6.1, 3.10.6.2, 3.10.6.3	4.6.9
Feedthrough suppression	3.10.7	4.6.9
Spurious echo suppression	3.10.8	4.6.9
Voltage standing wave ratio (VSWR)	3.10.9	4.6.9

4.5.1.3.1 Sampling plan. Sampling plan shall be in accordance with special procedures for small sample inspection of MIL-STD-105. The AQL shall be 6.5 percent defective using inspection level S-4.

4.5.1.3.2 Test routine. The samples specified in 4.5.1.3 shall be subjected to the tests in table VI in the order shown.

4.5.1.3.3 Rejected lots. If an inspection lot is rejected, the contractor may withdraw the particular lot once, screen out defectives, and reinspect once. Such lots shall be kept separate from new lots and shall be clearly identified as reinspected lots. Rejected lots shall be reinspected using tightened inspection.

4.5.1.4 Group C inspection. Group C inspection shall consist of the tests specified in table VII, in the order shown. Group C inspection shall be made on sample units selected from inspection lots which have passed groups A and B inspections.

4.5.1.4.1 Sampling plan. Six sample units of each type of filter circuit device shall be selected for each of subgroups 1, 2 and 3 at random from each lot as specified in 4.5.1.1.

4.5.1.4.1.1 Test routine. The samples selected in accordance with 4.5.1.3 shall be subjected to the tests shown in table VII. Not more than one defect shall be allowed for a single group of six samples.

4.5.1.4.2 Disposition of samples. Filter circuit devices subjected to group C inspection shall not be delivered on the contract or order. Samples emanating from lots which have passed groups A, B and C inspection may be delivered on the contract.

Table VII. Group C inspection.

Examination or test	Requirement paragraph	Test paragraph
Group I		
High temperature storage	3.11	4.6.10
Short circuit	3.9	4.6.8
Hermetic seal	3.6	4.6.5
Short circuit	3.9	4.6.8
Subgroup II		
Solderability (strip leads) (when applicable)	3.8	4.6.7
Life	3.15	4.6.14
Electrical characteristics (final)	3.10	4.6.9
Subgroup III		
Vibration	3.13	4.6.12
Short circuit	3.9	4.6.8
Shock	3.12	4.6.11
Short circuit	3.9	4.6.8
Thermal shock (10 cycles)	3.7	4.6.6
Short circuit	3.9	4.6.8
Moisture resistance	3.14	4.6.13
Electrical characteristics (final)	3.10	4.6.9

4.5.1.4.3 Noncompliance. If a sample fails to pass group C inspection, the contractor shall take corrective action on the materials or processes, or both, as warranted, and on all units of product which can be corrected and which were manufactured under essentially the same materials, processes, and so forth, and which are considered subject to the same failure. Acceptance of the product shall be discontinued until corrective action, acceptable to the government, has been taken. After the corrective action has been taken, group C inspection shall be repeated on additional sample units (all inspections or the inspection which the original sample failed at the option of the government). Groups A and B inspection may be reinstituted; however, final acceptance shall be withheld until the group C reinspection has shown that the corrective action was successful. In the event of failure, action shall be furnished to the contracting officer.

4.6 Methods of examination and test.

4.6.1 Visual.

4.6.1.1 Wafer (see 3.2.4.1 and 3.17). A government approved comparison standard shall be utilized using 1000X magnification.

4.6.1.2 Filter device (see 3.2.4.2 and 3.17). An examination for circuit inspections shall be performed under 20X magnification.

4.6.2 Adhesion of metallic film (see 3.2.1.2). A one-inch strip of pressure sensitive cellophane tape, conforming to type I, class A of Federal Specification L-T-90, shall be applied to the metallized surface, adhesion side down, employing firm hand pressure. The tape shall then be removed with one abrupt motion, and the adhesive side examined for detached particles of metallic film.

4.6.3 Dimensions (see 3.5.3). Dimensions shall be measured using a micrometer.

4.6.4 Lead integrity (internal wire bonding and strip lead). Filter devices shall be tested in accordance with method 2011 of MIL-STD-883, method 4.6.4.1 or 4.6.4.2 as applicable.

4.6.4.1 Internal wire bonding. The following details shall apply:

a. Test condition D - Tension.
b. Weight to be attached to lead - 2 grams.
c. Length of time weight is to be attached - A minimum of 10 seconds.

4.6.4.1.2 Strip lead. Test condition A - Tension.

4.6.5 Hermetic seal (see 3.6). Filter devices shall be tested in accordance with method 112B, MIL-STD-202. The following details shall apply:

a. Test condition - C.
b. Leak-rate sensitivity - 10^{-8} atm cc/sec.
c. Procedure IV, test for gross leaks using test condition A.

4.6.6 Thermal shock (see 3.7). Filter devices shall be tested in accordance with method 107, MIL-STD-202, test condition A (10 cycles).

4.6.7 Solderability (strip leads only, when applicable) (see 3.8). Filter devices shall be tested in accordance with method 2003 of MIL-STD-883. Each strip lead on a filter device shall be tested.

4.6.8 Short circuit and open circuit tests. All chips and filter circuit devices, as applicable, shall be tested for short circuits by any suitable means including the open circuit test between the external connection and the surface wave circuit.

4.6.9 Electrical characteristics (see 3.10). The government approved contractor's plan of electrical test methods, procedures and limits of degradation (electrical characteristics final) shall be used.

4.6.10 High temperature storage (see 3.11 and 3.9). Filter devices shall be tested in accordance with method 1008 of MIL-STD-883. The following details shall apply.

a. Test condition - A (75°C).
b. Test duration - 72 hours.
c. At the end of the exposure period, the devices shall be allowed to stabilize at room temperature and the filter device tested for short circuits.

4.6.11 Shock (specified pulse). Filter devices shall be tested in accordance with method 213 of MIL-STD-202. The following details shall apply:

a. Test condition - I
b. Method of mounting - Filter devices shall be rigidly mounted by their normal mounting means.

4.6.12 Vibration (low frequency) (see 3.13). Filters shall be tested in accordance with method 201 of MIL-STD-202. The filters shall be rigidly mounted by their normal mounting means.

4.6.13 Moisture resistance (see 3.14). Filters shall be tested in accordance with method 106D of MIL-STD-202. The following details shall apply:

a. Polarizing voltage - 50 Vdc
b. Final measurements - Before measurements, all units shall be removed from the test chamber and stabilized at room temperature. The filters shall be visually inspected and all electrical characteristics shall be performed and degradation limits shall be as indicated in the government approved contractor's plan.

4.6.14 Life (at elevated ambient temperature) (see 3.15). Filters shall be tested in accordance with method 108 in MIL-STD-202. The following details and exceptions shall apply.

a. Mounting - Normal mounting means as used in a system or sub-system.
b. Distance between filter devices - 6 inches.
c. Test temperature and tolerance - $85^{\circ}C \begin{smallmatrix} +10^{\circ}C \\ -5^{\circ} \end{smallmatrix}$.
d. Final measurements - Before measurements are made, all units shall be removed from the test chamber and stabilized at room temperature. All electrical characteristics shall be performed and degradation limits shall be as indicated in the government approved contractor's plan.

5. PREPARATION FOR DELIVERY.

The substrates, circuit chips and filters shall be in accordance with best commercial practices.

1950512-800

REVISIONS				
AUTHORITY	LTR	DESCRIPTION	DATE	APPROVED
DDT 89101	-	PRODUCTION RELEASE	78-10-17	J.G.D.

REV STATUS OF SHEETS																	
	SHEET	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
	REV	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	

LEVEL 3

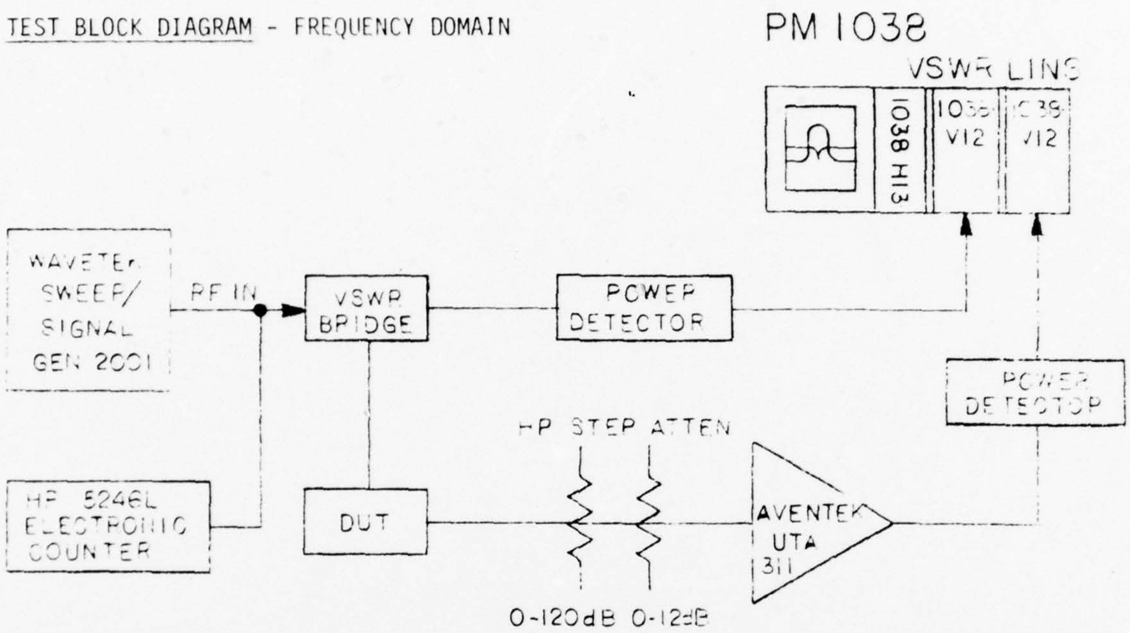
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES AND PER ANSI Y14.5	CONTRACT:		HUGHES — HUGHES AIRCRAFT COMPANY FULLERTON, CALIFORNIA
	DR D. CRISWELL	78-10-10	BANDPASS FILTER, TEST ACCEPTANCE PROCEDURE
.XXX -	CHK	78-10-17	
.XX -	APPD	10/16/78	SIZE A; FSCM NO. 05869; DWG NO. 1950512-800; REV -
ANGLES -	ISSUED	3-19	SCALE; WT; SHEET 1 OF 15

FORM 1

D14-338 GS 1/77

ACCEPTANCE TEST PROCEDURE

1.0 TEST BLOCK DIAGRAM - FREQUENCY DOMAIN



BLOCK DIAGRAM FOR MEASUREMENT OF VOLTAGE STANDING WAVE RATIO AND INSERTION LOSS IN THE FREQUENCY DOMAIN

2.0 TEST EQUIPMENT SETUP - FREQUENCY DOMAIN

2.1 Connect Horizontal output of the Wavetek 2001 to Horizontal input of PM 1038.

2.2 Connect RF output of the Wavetek 2001 to RF input of VSWR Bridge.

2.3 Connect the Channel A Power Detector of the PM 1038 to Reflected RF Output on the VSWR Bridge.

2.4 Connect Device under test on the VSWR Bridge to the input port of the test fixture.

2.5 Connect the output port of the test fixture to the two HP Step Attenuators.

2.6 Connect the two HP Step Attenuators to the input of the Aventek UTA-311 amplifier.

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1950512-800	
REV	SHEET 2

2.7 Connect the output of the Aventek UTA-311 amplifier to the Channel B Power Detector of the PM 1038.

2.8 Connect the RF output of the 2001 to the input of HP 5246L Electronic Counter.

3.0 OPERATING LEVELS AND CALIBRATION - FREQUENCY DOMAIN

3.1 Connect the HP Step Attenuators to Device Under Test on the VSWR Bridge.

3.2 Adjust output of the 2001 for maximum output. Place Mode switch to S/S. Select desired frequency band with the Band switch. Set TRIG/RECUR switch to RECUR. Put ALC switch into INT position. Select sweep width with START/STOP knobs. Set SWEEP TIME to 1-.1 position. Set all marker buttons to OUT position.

3.3 Set OFFSET dBm/dB selector to the Nominal Insertion Loss of the device to be tested on Channel B of PM 1038. Polarity switch out, Smooth switch out. Push INPUT dB switch in, push 10 dB/DIV switch in. Set REF LINE to CL.

3.4 Set HP Attenuators to the same setting as on the OFFSET dBm/dB selector.

3.5 Adjust the trace to center line on PM 1038 with the REFERENCE knob.

3.6 Check dB range by changing the HP Step Attenuators in 10 dB steps for a 10 dB change on the PM 1038. To prevent saturation of the UTA-311 amplifier add more attenuation on the HP Step Attenuators as needed.

3.7 Select greater sensitivity on the dB/DIV of the PM 1038 centering the reference each time. Select ACESS MEMORY, slow down the SWEEP TIME on the 2001. Depress the PRESS TO STORE button on the PM 1038 for at least one sweep of the trace. Push the MEMORY button to make sure the trace you just saw is in memory. Then select INPUT MINUS MEMORY. The center line is now equal to dB on the OFFSET dBm/dB selector.

3.8 Remove from the HP Step Attenuators the same amount of dB selected on the OFFSET dBm/dB on the PM 1038.

3.9 Reconnect the attenuators and VSWR Bridge to the test fixture.

3.10 Select a resistive load to match the VSWR required for the device being tested and place in the test fixture.

3.11 Set OFFSET dBm/dB to 00.0 on Channel A of the PM 1038. Set Polarity and smooth switch out. Push INPUT dB switch in. Depress 10dB/DIV in. Set REF LINE TO C.L. Adjust trace to the center line on the PM 1038 with the REFERENCE knob. Select greater sensitivity on dB/DIV centering the reference each time. Select ACESS MEMORY. Slow SWEEP TIME on the 2001 down. Depress the PRESS TO STORE button on the PM 1038 for at least one sweep of the trace. Push the MEMORY button to make sure the trace you just saw is in memory. Then select INPUT MINUS MEMORY. Center line is now equal to the VSWR desired.

4.0 <u>CALIBRATION OF TIME DOMAIN TEST SETUP</u>

4.1 Set the HP608D signal generator for proper center frequency of device under test.

4.2 Set amplitude output for maximum RF output.

4.3 Set the EH 139B pulse generator for a 8 KHz repetition rate, 1 μ sec Pulse Width with an amplitude of 2v peak to peak and an offset of -1v.

4.4 For BPQ, BPLN, PCQ, PCLN plugin a good device into the test fixture and fine adjust the pulse width, ramp rate (rise and fall), offset and amplitude to obtain peak output of the device. All measurements made on the BPQ, BPLN, PCQ, PCLN are made with reference to the peak of the response.

4.5 For TDL-100 and TDL-200 replace the D.U.T. (device under test) with a straight through connection. Fine adjust the pulse width, Ramp rate (rise and fall), Offset and amplitude making sure that each bit from the TDR (reverse coded line) is of equal amplitude. When this is done use the peak of this amplitude as a reference for making the insertion loss measurement of the delay line.

5.0 *<u>TEST EQUIPMENT SETUP</u> - TIME DOMAIN*

5.1 Connect RF output of the HP608D signal generator to the HP 5246L counter.

5.2 Connect TRIG OUT of the EH 139B Pulse generator to Ext. TRGIN on the HP138A OSCILLOSCOPE.

5.3 Connect OUT on the EH139B Pulse generator to SW on RF switch #1 and RF switch #2.

5.4 Connect RF output of the HP608D signal generator to IN on RF switch #1.

5.5 Connect OUT on RF switch #1 to IN on RF switch #2.

5.6 For PCQ and PCLN go to step 11. For BPQ and BPLN go to step 16. For TDL-100 and TDL-200 continue to next step.

5.7 Connect OUT of RF switch #2 to IN of UTA311 amplifier #1.

5.8 Connect OUT of UTA311 amplifier #1 to input of the TDR (reverse coded delay line).

5.9 Connect output of the TDR to IN of UTA311 amplifier #2.

5.10 For TDL-100 and TDL-200 go to step 13.

5.11 For PCQ and PCLN connect OUT of RF switch #2 to input of PELN (pulse expansion line).

5.12 Connect output of PELIV to IN of UTA311 amplifier #2.

5.13 Connect OUT of UTA311 amplifier #2 to a 10dB pad.

5.14 Connect 10dB pad to IN of UTA311 amplifier #3.

5.15 For TDL-100, TDL-200, PCQ and PCLN go to step 17.

5.16 For BPQ and BPLN connect OUT of RF switch #2 to IN of UTA311 amplifier #3.

5.17 Connect OUT of UTA311 amplifier to a 10dB pad.

5.18 Connect 10dB pad to IN of AV9M amplifier.

5.19 Connect OUT of AV9M amplifier to input of D.U.T. (device under test).

5.20 Connect output of D.U.T. to HP355D step attenuator.

5.21 Connect HP355D step attenuator to HP355C step attenuator.

5.22 Connect HP355C step attenuator to IN of UTA311 amplifier #4.

5.23 Connect OUT of UTA311 amplifier #4 to channel A of HP138A oscilloscope.

6.0 MEASUREMENT PROCEDURE

6.1 Insertion Loss For the BPQ, BPLN, PCQ and PCLN insertion loss is measured in the frequency domain. With the frequency domain equipment setup and calibrated, for the device under test set the peak of the response to the reference line by adjusting the OFFSET dBm/dB selectors on channel B of the PM 1038. The insertion loss can be directly read from the OFFSET dBm/dB selector. Record this value.

Insertion loss for the TDL-100's and TDL-200's is measured in the time domain. See Figure 3.

By connecting an RF barrel connector (straight through connection) (in place of the device under test) and adjusting the step attenuators (HP355C&D) and oscilloscope preamplifier gain for full scale deflection on the oscilloscope display, the reference or maximum signal level is established. Note and record the Step Attenuator (HP335C&D) settings. When the barrel connector is removed and the device under test is installed in its place, a smaller signal amplitude will be noted on the oscilloscope presentation. Do not change the oscilloscope preamplifier gain. Decrease the step attenuator settings until the signal amplitude is exactly full scale on the oscilloscope presentation. The change (decrease) in attenuator settings is the Insertion Loss in dB.

6.2 3dB Bandwidth This is measured on the BPQ and BPLN only. The bandwidth is measured in the frequency domain.

Select 1dB/DIV. Set REF LINE to +3. Rotate frequency control to -3dB below the main response on the low frequency side of the passband. Record this frequency. Rotate the frequency control to -3dB below the main response on the high frequency side of the passband. Record this frequency. Determine the bandwidth as follows:

$$fhi - flo = BW$$

Record this value.

TIME DOMAIN SETUP FOR BPQ AND BPLN

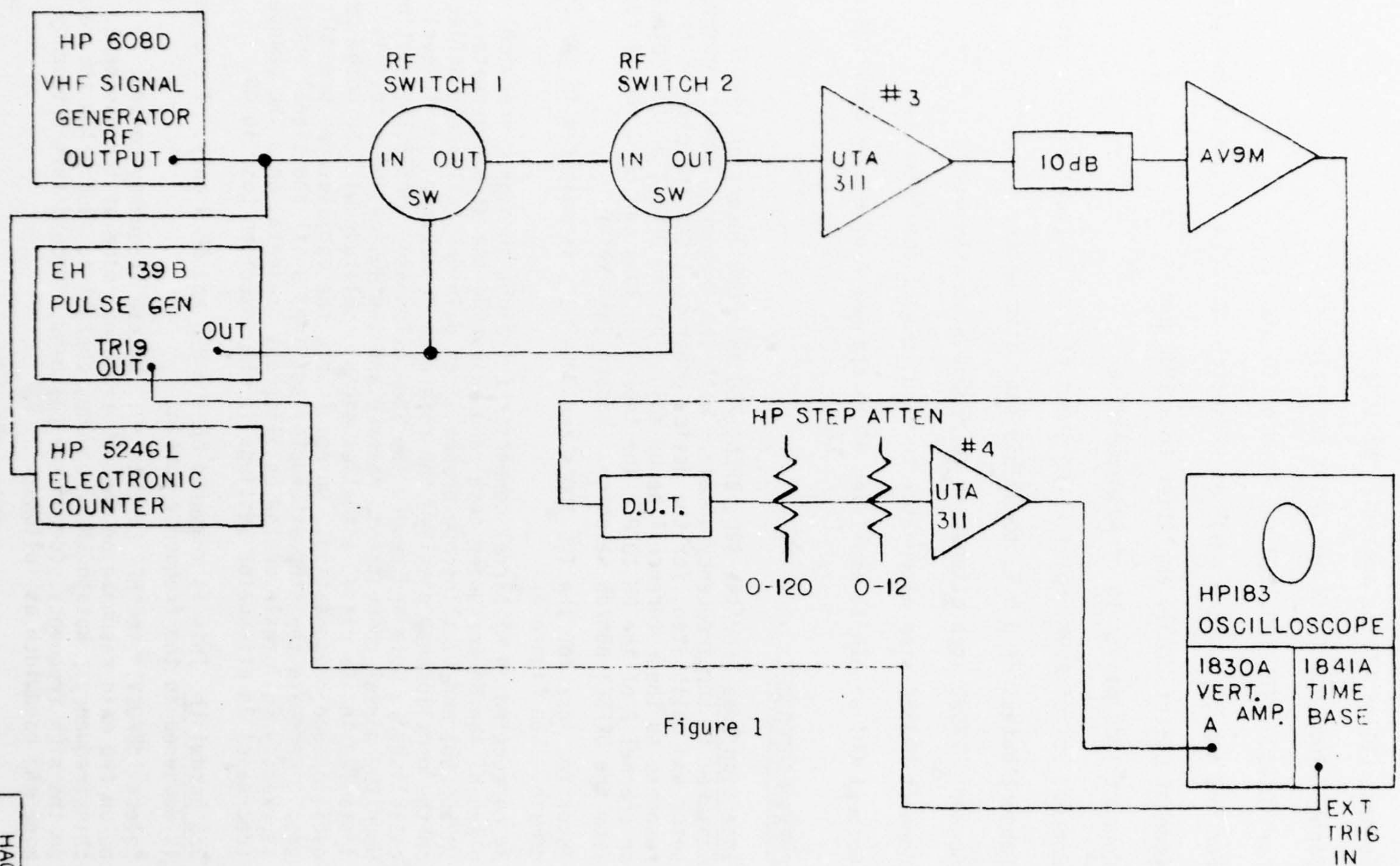


Figure 1

HAC DWG No.	
1950512-800	
REV.	SHEET 6

TIME DOMAIN SETUP FOR PCQ AND PCLN

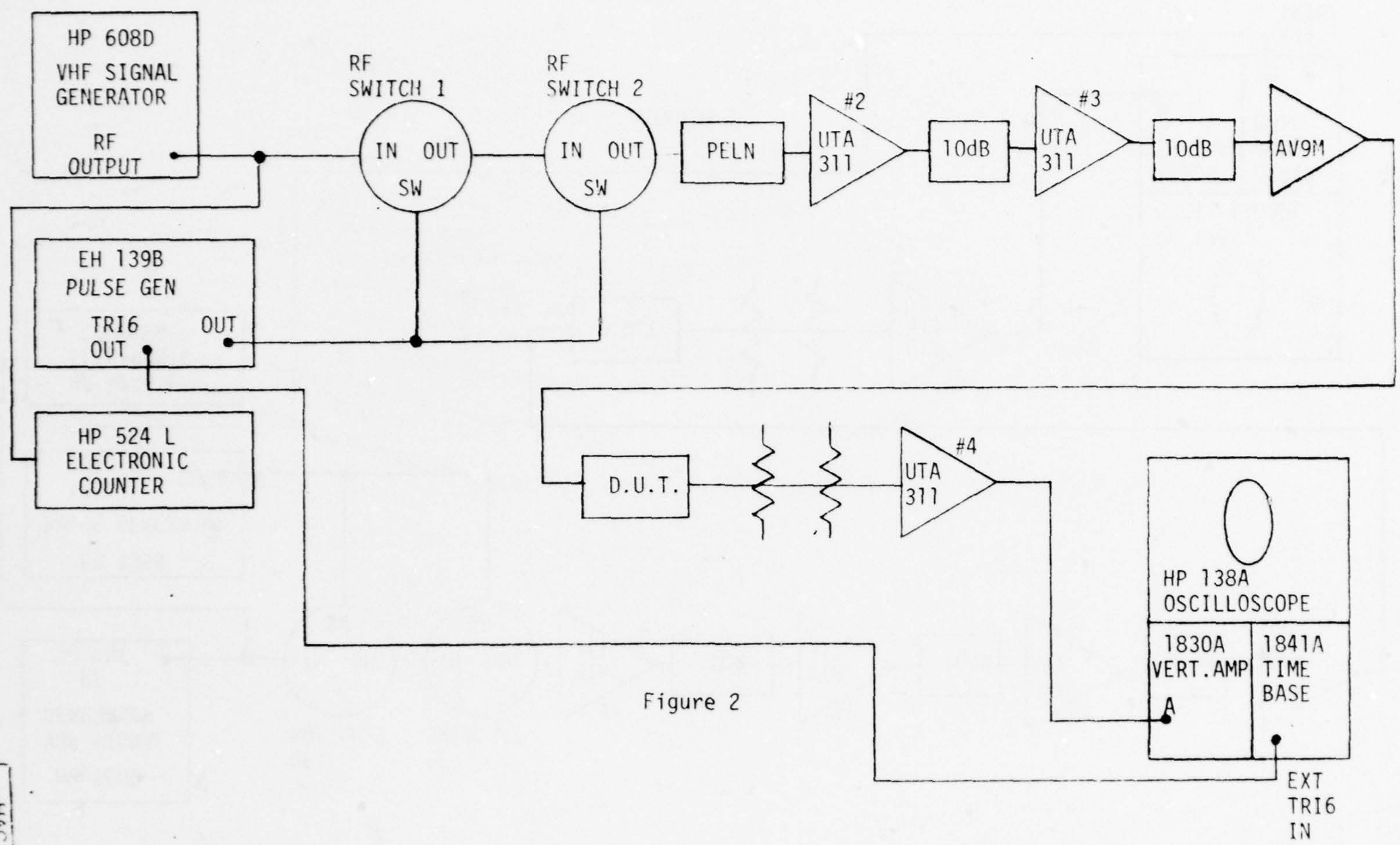


Figure 2

HAC DWG No.
1950512-800
REV. | SHEET 7

TIME DOMAIN SETUP FOR TDL-100 AND TDL-200

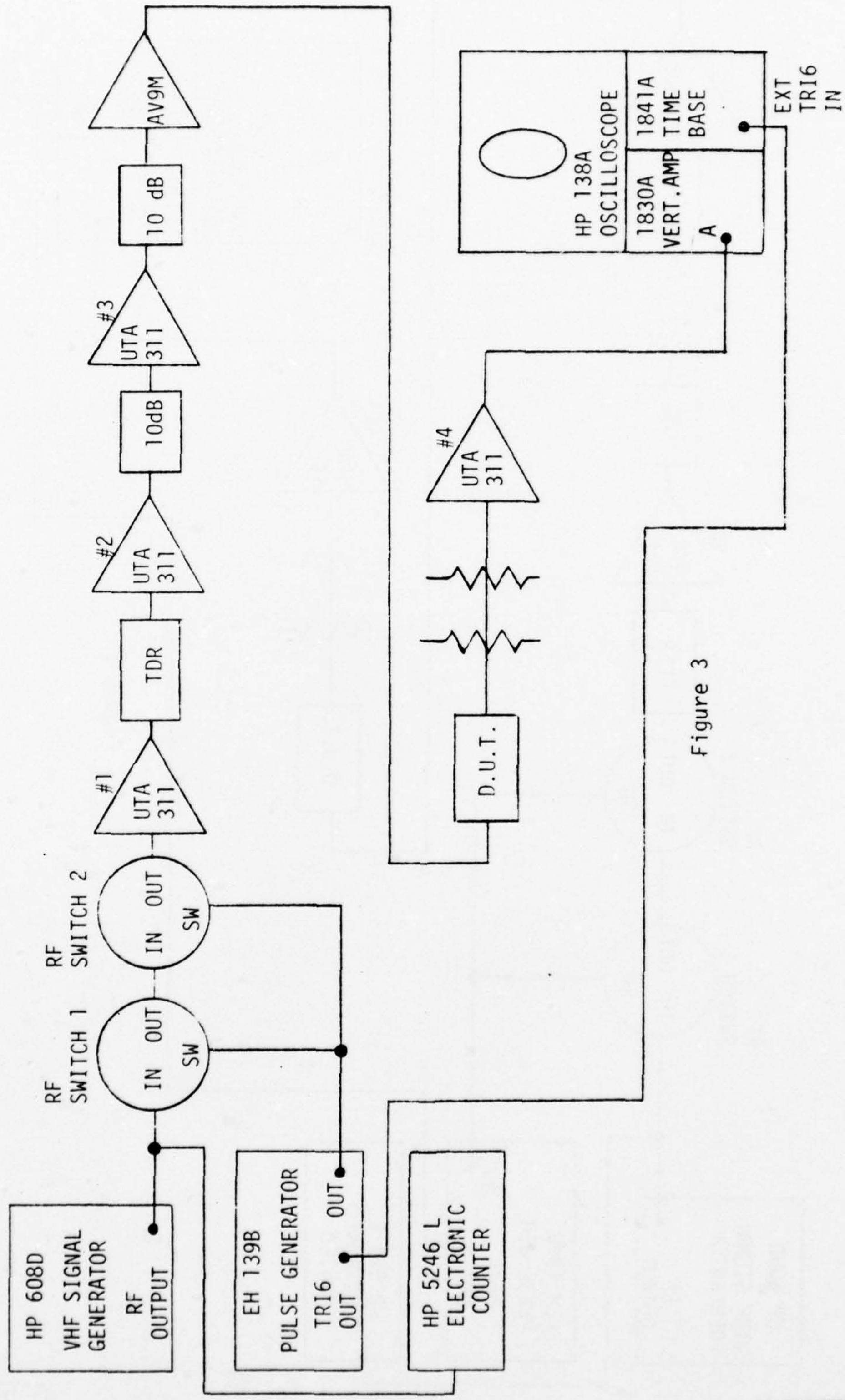


Figure 3

HAC DWG No.	
1950512-800	
REV.	SHEET 8

TEST SETUP FOR MEASURING CENTER FREQUENCY
OF TDL-100 AND TDL-200

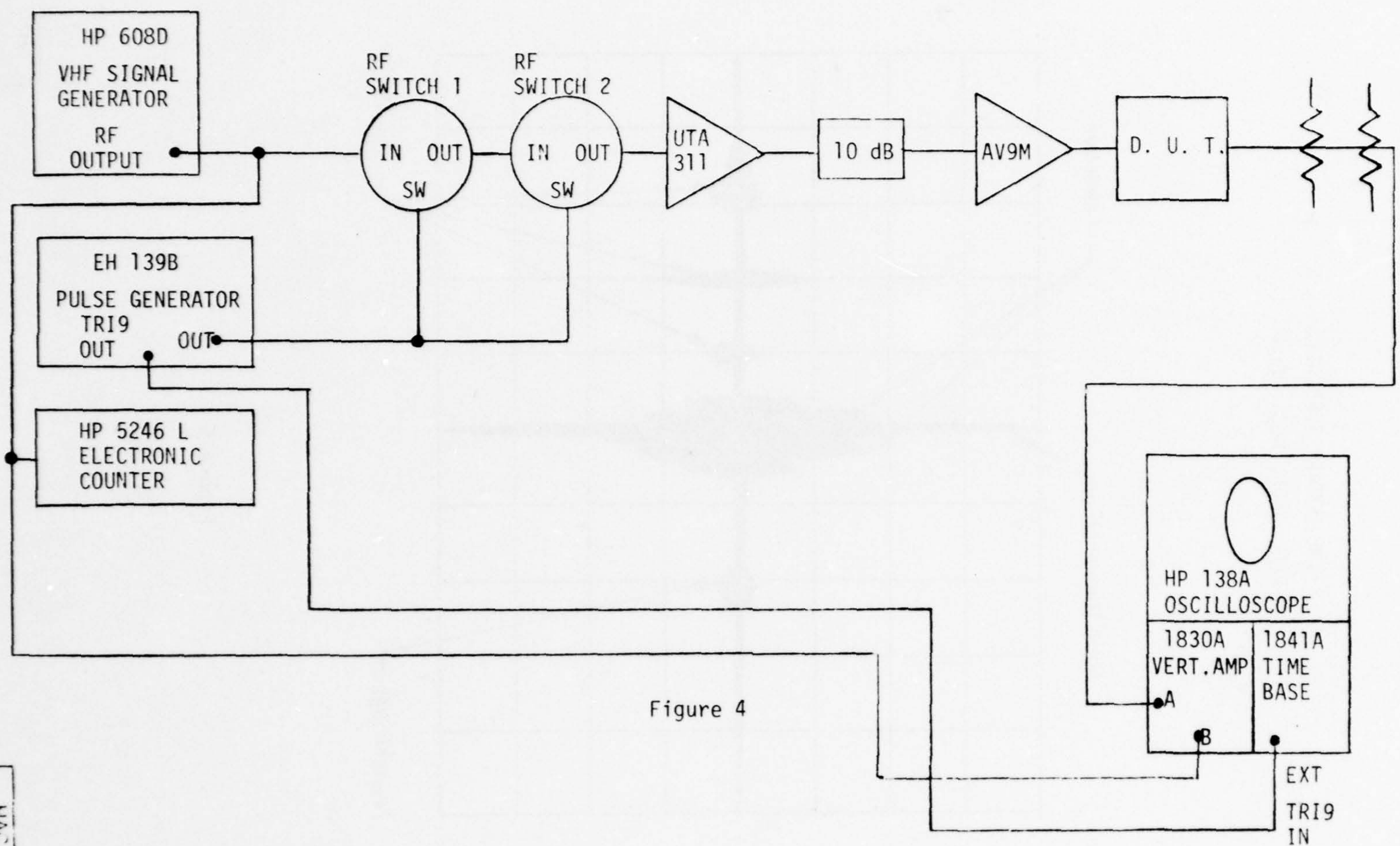


Figure 4

HAC DWG No.
1950512-800
REV. | SHEET 9

TIME DOMAIN RESPONSES
BPQ, BPLN, PCQ, PCLN

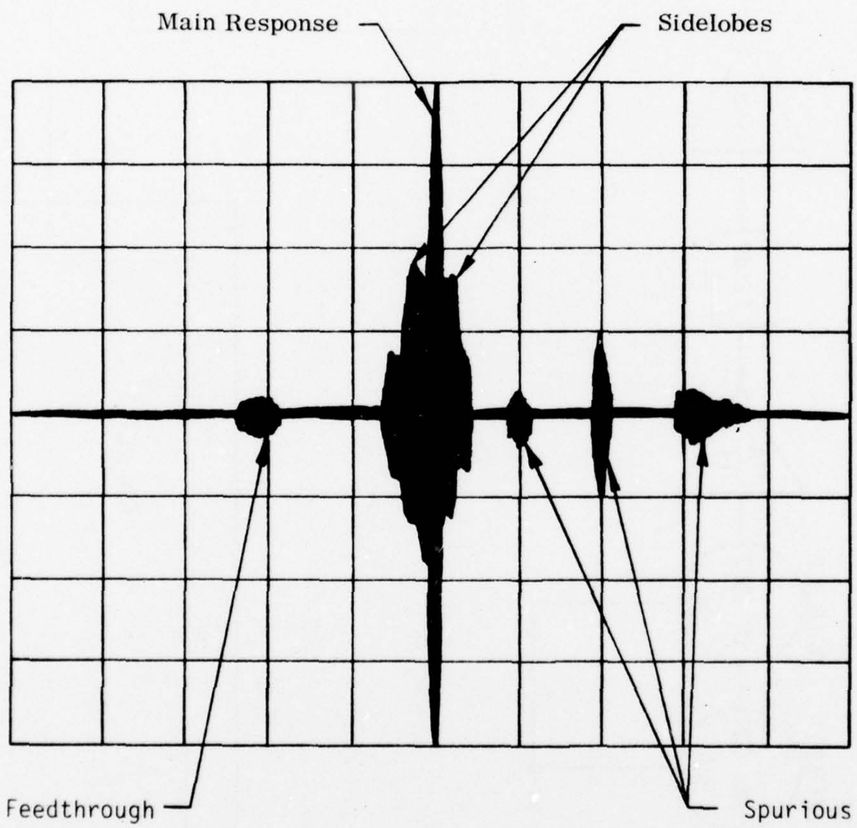


Figure 5

HAC DWG No.	
1950512-800	
REV.	SHEET 10

TIME DOMAIN RESPONSES

TDL-100, TDL-200

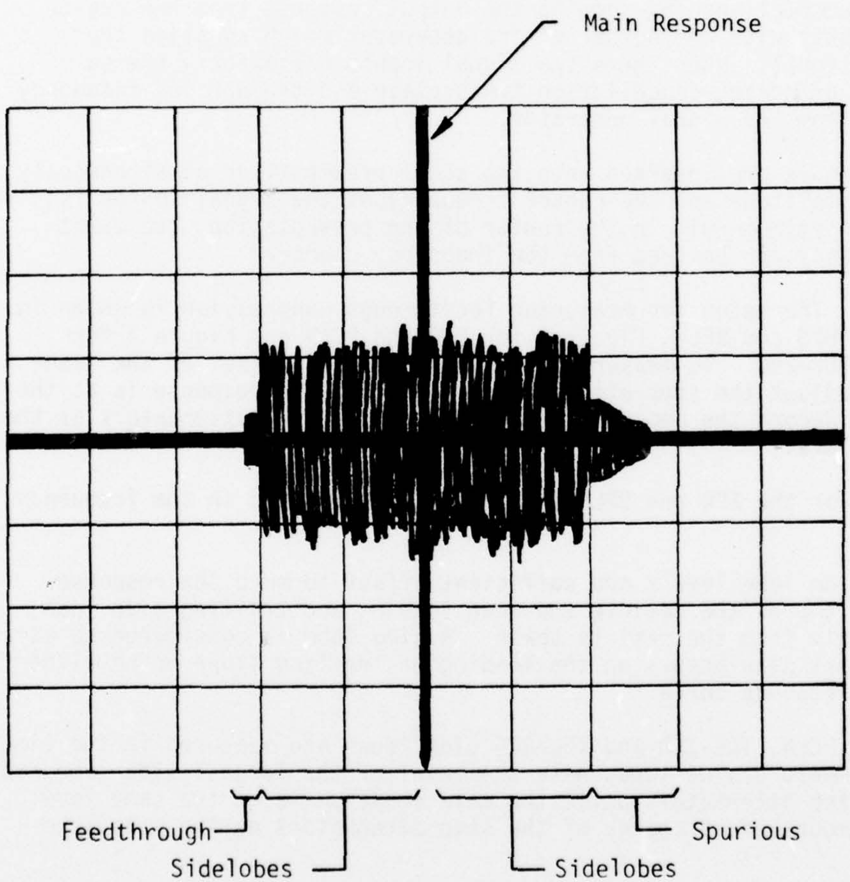


Figure 6

HAC DWG No.	
1950512-800	
REV.	SHEET 11

6.3 Center Frequency For the BPQ and BPLN. Determine center frequency using the frequency measurements taken to determine the bandwidth and use this formula:

$$\frac{fhi + flo}{2} = fo$$

Center frequency for the TDL-100 and TDL-200 is measured with the time domain equipment. See Figure 4.

The test is accomplished by summing the output response from the device under test (DUT) with the output of the generator which supplies the original RF signal. When these two signal inputs are exactly the same, but 180^{0} out of phase, cancellation takes place and the precise frequency can be read from the signal generator.

When both signals are inserted into the scope preamplifier simultaneously at the same amplitude and the center frequency of the signal source is adjusted for optimum null in the center of the presentation, the exact center frequency can be read from the frequency counter.

6.4 Feedthrough The setup for measuring feedthrough suppression is shown in Figure 1 for BPQ and BPLN, Figure 2 for PCQ and PCLN and Figure 3 for TDL-100 and TDL-200. To measure feedthrough note the level of the feedthrough and adjust the step attenuators until the main response is at the same level. Record the amount of dB change of the step attenuators as the feedthrough level.

6.5 Side Lobes For the BPQ and BPLN side lobes are measured in the frequency domain.

To measure side lobe levels add sufficient offset to move the response curve to the top of the reticle and read leading and trailing side lobe levels directly from the reticle scale. A side lobe is considered to exist when a distinct peak occurs on the leading or trailing slope or on either side of the response curve.

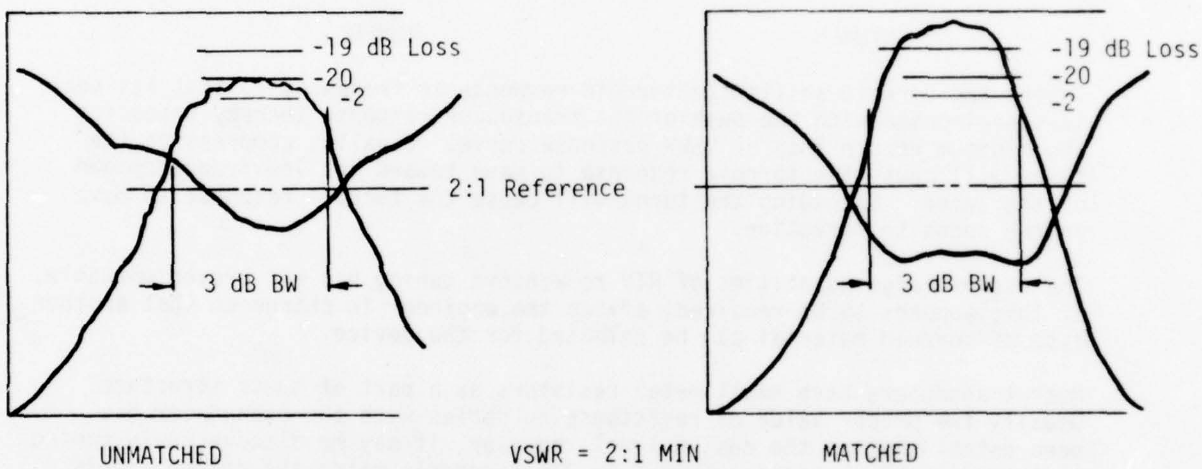
For the PCQ, PCLN, TDL-100 and TDL-200 side lobes are measured in the time domain. To measure side lobes note the level of the largest side lobe and adjust the step attenuators until the main response is at the same level. Record the amount of dB change of the step attenuators as the side lobe level.

6.6 Spurious For the BPQ, BPLN, PCQ, PCLN, TDL-100 and TDL-200 spurious signals are measured in the time domain. To measure the spurious signals note the level of the largest spurious signals and adjust the step attenuators until the main response is at the same level. Record the amount of dB change of the step attenuators as the spurious level.

6.7 VSWR: For the BPQ, BPLN, PCQ, PCLN, TDL-100 and TDL-200 the VSWR is measured in the frequency domain. With the PM 1038 calibrated to the desired VSWR check both the input part and the output part to verify the specified VSWR.

APPENDIX: Tuning Bandpass Filters and Pulse Compression Filters (applies to all types of test equipment setups)

The center frequency of SAW devices is determined by the transducer design and is fixed by the metalized pattern deposited on the surface of the crystal. Tuning the packaged devices does not significantly alter the center frequency although it may skew the response curve and effect the 3dB bandwidth. The major purpose for tuning a SAW device is to minimize the input and output VSWR or "match" the SAW device to external circuit element. A device is "matched" or tuned when the return loss is minimized within the 3dB bandwidth unless otherwise specified. The sketches below illustrate a matched and an unmatched filter response.

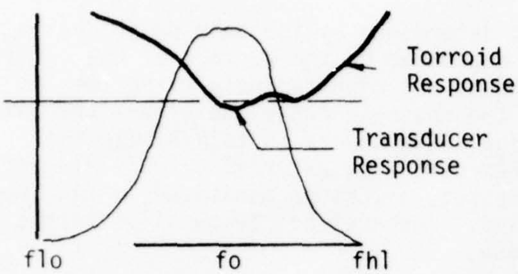


Thus, tuning is usually done by monitoring the return loss. Tuning is electrically accomplished by the addition of series or parallel inductance to compensate for the inherent capacitance of the metalized pattern. It is physically accomplished by expanding or compressing turns on a torroidal powdered iron core using a pair of tweezers. When the desired response is achieved, the core and the turns on it are held in position by the addition of RTV compound. The RTV compound if used to excess will also influence the tuning. So also will the orientation of the core and the proximity of a metal cover.

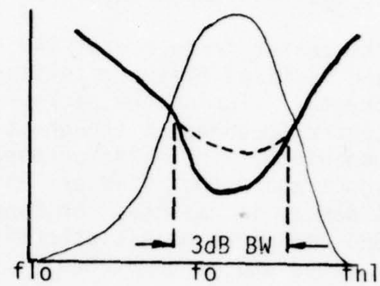
The procedure then is to install the unit to be tuned into a properly calibrated test setup and expand or compress the turns on the core whose terminals are connected to the SWR Bridge so that the VSWR response is centered on the 3dB bandwidth of the device.

If the sweep width of the generator is set very wide compared to the bandpass of the device to be tested, it will be noted that the VSWR response is a composite of two curves. One curve is the resonance of the transducer. This is usually approximately equal to the 3dB bandwidth of the device being tested. The second curve is the response of the torroid and its parasitic

capacitance. This is usually quite broad. The illustration below shows this phenomena.



UNTUNED

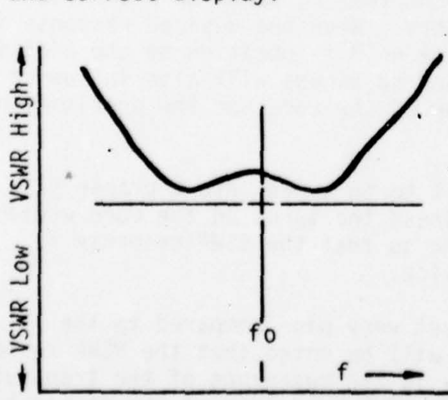


TUNED

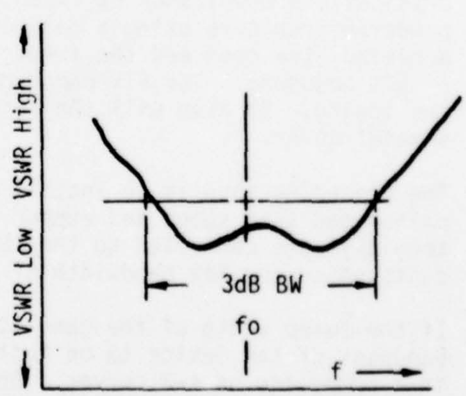
Tuning the torroid shifts the torroid response in frequency so that its peak is superimposed with the peak of the transducer response thereby producing the minimum return loss or VSWR response curve. Usually, compressing the turns will cause the torroid response to move toward the low frequency end of the sweep. Spreading the turns will cause the torroid response to move in the opposite direction.

The use of large quantities of RTV to achieve tuning has not proven workable. If this appears to be required, advise the engineer in charge so that another type of torroid material can be selected for the device.

Most transducers have small metal resistors as a part of their structure. Usually the proper value of resistance in series with the transducer has been established at the design level, however, it may be discovered in tuning that additional resistance is required to properly match the device. This can be caused by variation of metal thickness in fabrication. The indication that more resistance is required occurs when the VSWR response curve is properly tuned frequencywise (both responses superimposed) but the VSWR is too great over the 3dB bandwidth. The illustration below shows the incorrect and correct display.



INSUFFICIENT RESISTANCE



CORRECT RESISTANCE

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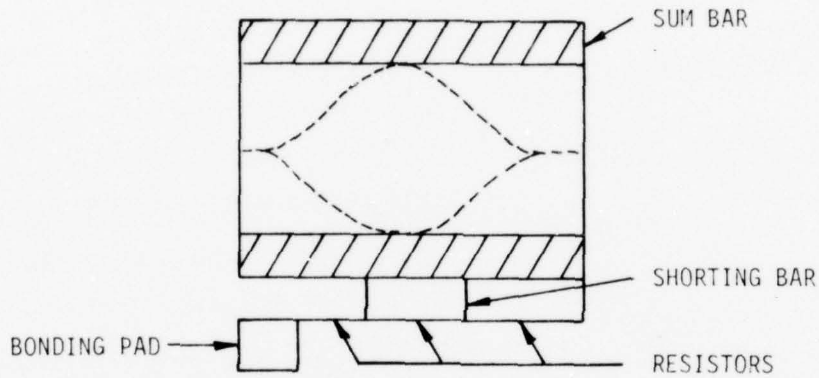
1950512-800	
REV.	SHEET 14

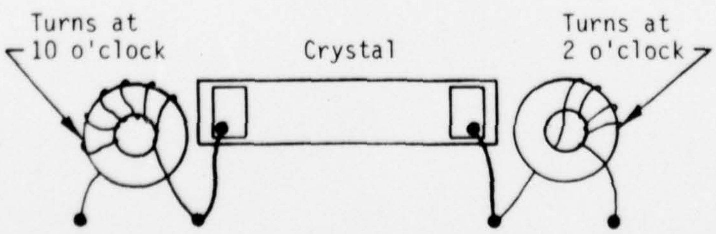
The incorrect condition above can be remedied by the addition of a section of resistance in the transducer, however, a slight detuning may be noted as the resistor will add a small amount of series inductance. This additional inductance can usually be tuned out by spreading the turns on the torroid.

Each transducer has several sections of resistors which are shorted out by thin metal shorts. Resistance is added by scribing through the shorting bars. This is a delicate operation. Consult your supervisor for approval and technique before attemption to add resistance. The sketch below shows a typical transducer pattern with resistors.

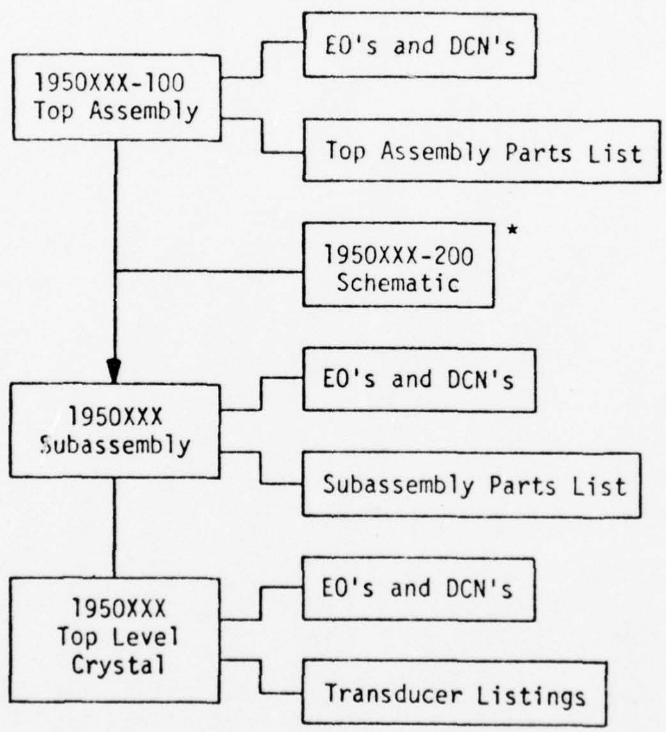


The addition of resistors will also increase insertion loss and can be used for this purpose. In general the VSWR will be improved by adding resistance so that increasing insertion loss by this method results in a better VSWR. On the other hand improving VSWR by this method may increase insertion loss beyond specification. In any case advise your supervisors if the addition of resistance is required so he can establish the reason for it and can modify metal thickness or whatever may be the cause.

The orientation of the turns on the torroidal cores sometimes influences feedthrough suppression. In those cases where this has appeared as a problem it has been found that the greatest feedthrough suppression occurs when the turns are positioned away from the crystal as shown below:

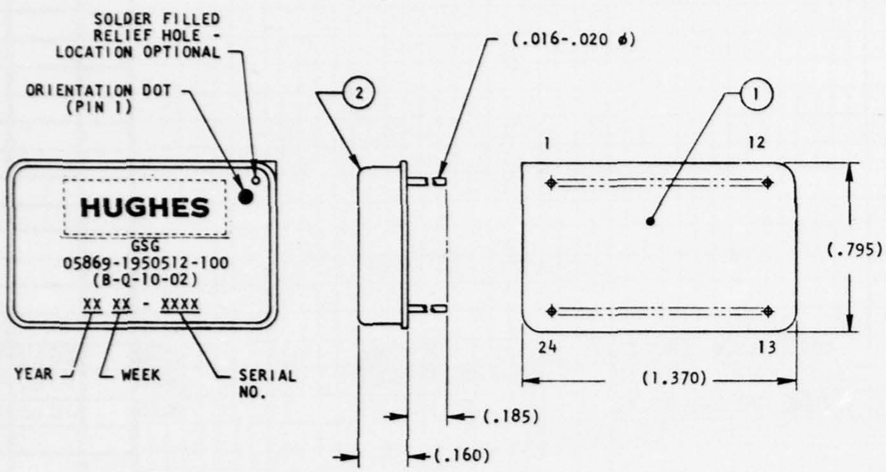


DRAWING HEIRARCHY SCHEMATIC



*Optional, can be included in 1950XXX.

REVISIONS					
AUTHORITY	ZONE	LTR	DESCRIPTION	DATE	APPROVED
DDT 74356		-	PRODUCTION RELEASE	77-11-10	



NOTES - UNLESS OTHERWISE SPECIFIED

1. FOR SCHEMATIC DIAGRAM SEE 1950513.
2. THIS ITEM SHALL MEET THE REQUIREMENTS OF 1950512-600.
3. IDENTIFICATION MARKING PER P80-3.
4. SEAL ASSEMBLY USING ITEM 3 OR BY PROJECTION WELDING (MFG OPTION).

SEE SEPARATE PARTS LIST

-	SAW MMT
NEXT ASSY	USED ON
APPLICATION	

EXCEPT AS NOTED DIM. ARE IN INCHES AND PER ANS Y14.5
.XXX .XX ANGLES
±.010 ±.03 ±0°30'
MATERIAL

CONTRACT: DAAB07-75-C-0044
DR L. Y. Azakaki 77/10/27
CHK R. Burns 77-10-27
APPD 77-11-04

HUGHES — HUGHES AIRCRAFT COMPANY, FULLERTON, CALIFORNIA

DELAY LINE, SURFACE ACOUSTIC WAVE — CENTER FREQ 100 MHz, BANDWIDTH 2 MHz (BANDPASS FILTER)

SIZE	CODE IDENT NO	DRAWING NO.	REV
B	05869	1950512-100	
SCALE NONE		SHEET	

11-063B-1 GS 7/73

12-66-42

FORM 3

PARTS LIST TRANSMITTAL

HUGHES AIRCRAFT COMPANY
FULLERTON, CALIFORNIA

ISSUE:
ACTION: A

10 CONTRACT: DAAB07-75-C-0044

PL 1950512-100

CODE IDENT: 05869

11 REV: - 77 09 23 (YR MO DAY)

12 LIST TITLE: DELAY LINE, SAW

13 MAINT:

14 PROJECT: SAW MMT

15 REFERENCE NO.:

16 REV AUTH:

SHEET 1 OF 1

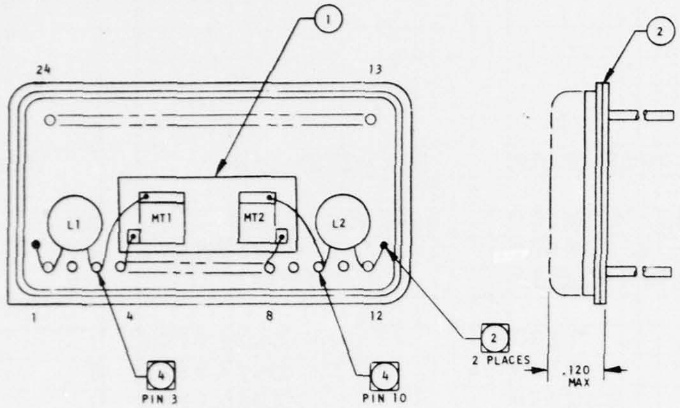
ACTION	ITEM NO.	LINE NO	QUANTITY REQUIRED (20)	UNIT OF MEAS (21)	CODE IDENT (22)	PART OR IDENT NUMBER (23)	DESCRIPTION (24)	SPECIFICATION OR REFERENCE (25)	REF DESIGNATION FROM (26)	REF DESIGNATION THRU (27)	AUTH (28)	WT LB (29)	PL NOTE (30)
A	1		1			1950513	SUBASSY						
A	2		1		29172	20216	COVER	TEKFORM					
A	3		AR			4277250-996	SOLDER, SN96IW5	QQ-S-571					
A	4900		REF			1950513	SCHEMATIC DIAG						
A	4901		REF			1950512-600	DESGN PERF SPEC						
A	4902		REF			P80-3	IDENT MARKING						

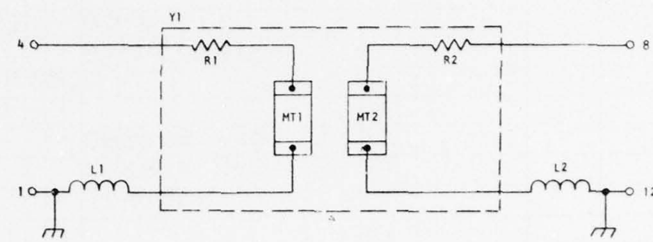
PREPARED BY: H. Burns DATE: 77-09-23 CHECKED BY: DATE: 77- APPROVED BY: [signature] DATE: 77-11-09 APPROVED BY: DATE: 77-

AUTHORITY	LTR	DESCRIPTION	DATE	APPROVED
DDT 74356	-	PRODUCTION RELEASE	77-11-…	…

REVISIONS

92508-10





SCHEMATIC DIAGRAM

NOTES - UNLESS OTHERWISE SPECIFIED:

1. ATTACH ITEM 1 TO ITEM 2 USING ITEM 7.
2. SOLDER LEADS OF L1 AND L2 TO HEADER AND HEADER PINS AS SHOWN USING ITEM 8.
3. ALL OTHER CONNECTIONS ARE WIRE BONDS PER MIL-STD-883, METHOD 2017 USING ITEM 6.
4. CLIP INDICATED PIN FLUSH WITH FAR SIDE OF HEADER.
5. (NOT USED)
6. TUNE L1 AND L2 TO MEET PERFORMANCE REQUIREMENTS OF 19500512-600 BY ADJUSTING SPACING BETWEEN TURNS. THEN BOND TO ITEM 2 USING ITEM 7.

SEE SEPARATE PARTS LIST

1950512-100	SAW MMT	EXCEPT AS NOTED DIM ARE IN INCHES AND PER ANSI Y14.5 XXX XX ANGLES ±.010 ±.03 ±0.5°	CONTRACT DAAB07-75-C-0044	HUGHES	HUGHES AIRCRAFT COMPANY FULLERTON, CALIFORNIA
NEXT ASSY	USED ON	MATERIAL	DR	DELAY LINE SUBASSEMBLY, SURFACE ACOUSTIC WAVE - CENTER FREQ 100 MHz, BANDWIDTH 2 MHz	
APPLICATION			CHK R. Burns 77-11-08		
			APPD	SIZE C · FSCM NO 05869 · DWG NO 1950513	REV
		12-67-31	FORM 3	SCALE NONE	SHEET

DWG NO 1950513 SH REV

FORM NO. 11004B-CS-GS REV. 7/76
DIETERICH-POST CLEARPRINT 1000H-10

PARTS LIST TRANSMITTAL

HUGHES AIRCRAFT COMPANY
FULLERTON, CALIFORNIA

ISSUE: | ACTION: A | 10 CONTRACT: DAAB07-75-C-0044 | PL 1950513 | 05869 | 77 09 26

12 LIST TITLE: DELAY LINE SUBASSY, SAW | 13 MAINT | 14 PROJECT: MMT | 15 REFERENCE NO. | 16 REV AUTH | SHEET 1 OF 1

	ITEM NO.	LINE NO.	QUANTITY REQUIRED 20	UNIT OF MEAS 21	CODE IDENT 22	PART OR IDENT NUMBER 23	DESCRIPTION 24	SPECIFICATION OR REFERENCE 25	REF DESIGNATION FROM 26	THRU 27	AUTH 28	WT LB 29	PL NOTE
A	1		1			1950514	CRYSTAL		Y1				
A	2		1		29172	20221	HEADER	TEKFORM					
A	3		1		55167	850-13	COIL	CORONA MAG	L1				
A	4		1		55167	850-11	COIL	CORONA MAG	L2				
N	5												
A	6		AR			760660-11	WIRE, GOLD .001						
A	7		AR		71984	3140 RTV	ADHESIVE	DOW CORNING					
A	8		AR			4277250-999	SOLDER, SN63	QQ-S-571					
A	4900		REF			MIL-STD-883	WIRE BOND SPEC						

PREPARED BY: H. Burns | DATE 77-09-26 | CHECKED BY: | DATE 77- - | APPROVED BY: [signature] | DATE 77-11-09 | APPROVED BY: | DATE 77- -

AUTHORITY	LTR	DESCRIPTION	DATE	APPROVED
		REVISIONS		
DLT 86948		PRODUCTION RELEASE	78-08-29	[signature]

NOTES:

1. MATERIAL: QUARTZ (ST CUT, X PROPAGATING) PER 760781.
2. FABRICATE PER 780294
3. DEPOSITION THICKNESS:
   0.20 ± 0.01 µm
   (2000 ± 100 Å)

4. INDICATES DIRECTION OF SPECIFIED CRYSTALLINE AXIS & PROPAGATION DIRECTION.

5. HORIZONTAL CENTERLINES OF MT1 & MT2 SHALL BE CO-LINEAR WITHIN AND PARALLEL TO X-AXIS WITHIN 0.25°.

6. IN DIMENSIONAL LISTINGS, THE NO. FOLLOWING THE LETTER E INDICATES THE POWER OF 10 BY WHICH THE NO. MUST BE MULTIPLIED TO OBTAIN THE CORRECT VALUE. FOR EXAMPLE:

   $1.45870E-02 = 1.45870 \times 10^{-2} = 0.014587$

   $1.34567E\ 00 = 1.34567 \times 10^{0} = 1.34567$

7. DEPOSITION FILM APPLIED IN INDICATED AREA.

8. INDICATED SURFACE TO BE CORRUGATED PER P82

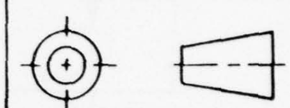
9. BACK SURFACE TO BE ROUGHENED WITH #180 GRIT.

10. TO BE DETERMINED AT TIME OF FABRICATION.

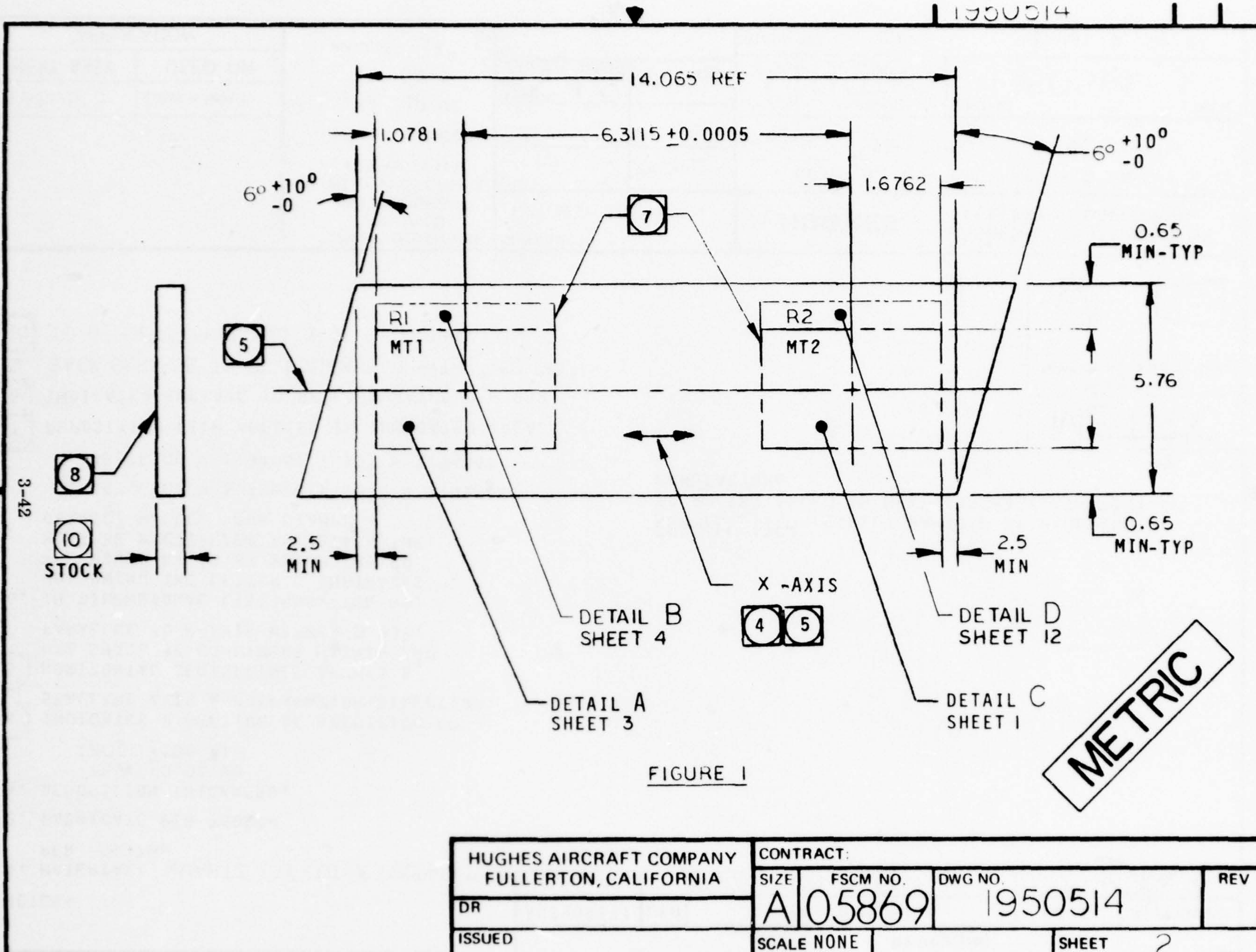
FRAGILE ITEM (EASILY DAMAGED BY HANDLING) - TO BE INSTALLED IN NEXT ASSEMBLY AT POINT OF MANUFACTURE.

METRIC

THIRD ANGLE (AMERICAN) PROJECTION

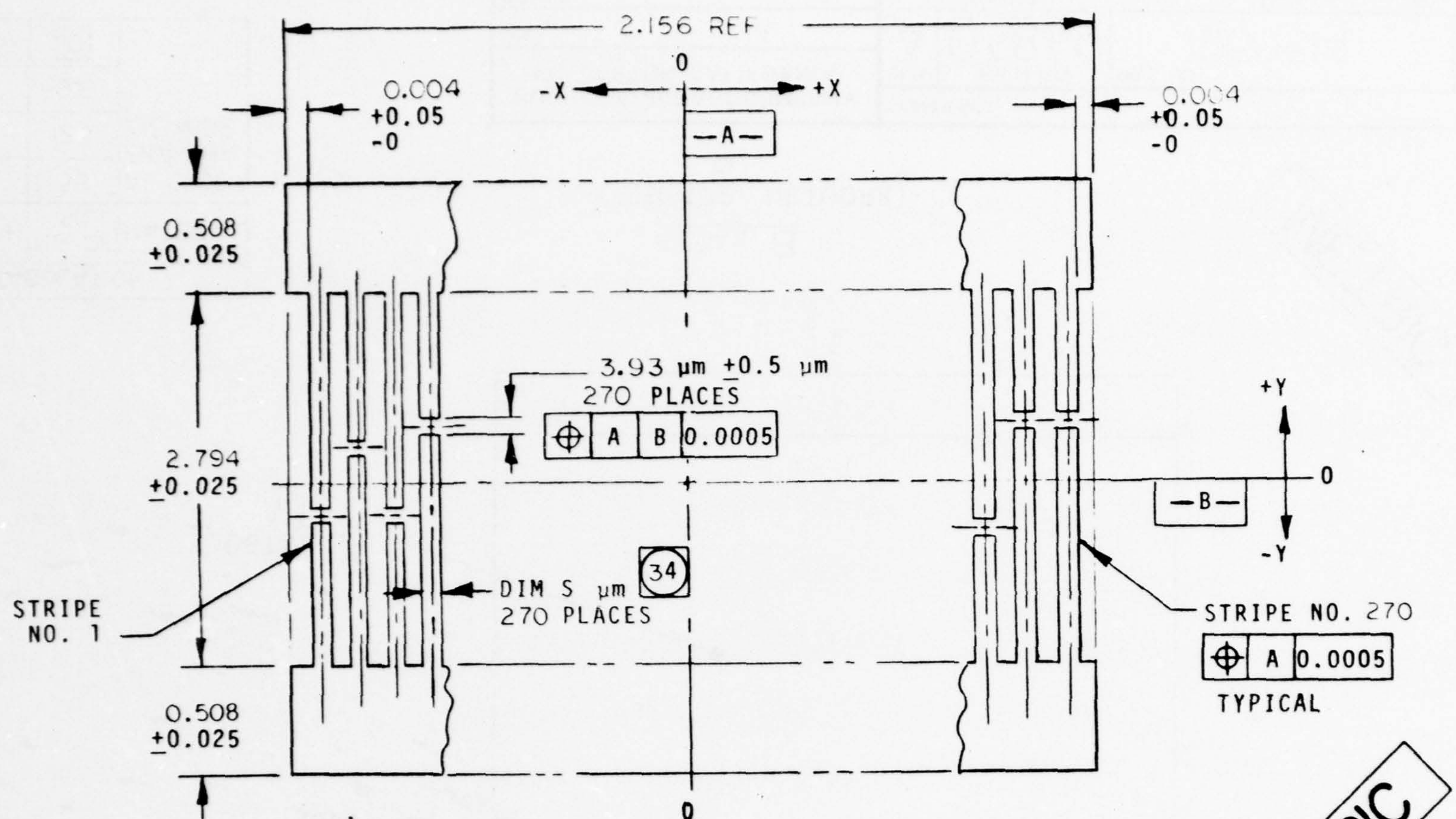


1950513	SAW-MMT	UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN MILLIMETERS & PER ANSI Y14.5	CONTRACT: DAAB07-75C-0074	HUGHES — HUGHES AIRCRAFT COMPANY, FULLERTON, CALIFORNIA
NEXT ASSY	USED ON	.XXX ±0.002	DR [signature] 78-09-25	CRYSTAL, SURFACE ACOUSTIC WAVE - BP-Q 100MHz CENTER FREQ., 2 MHz BANDWIDTH
APPLICATION		.XX ±0.02	CHK	SIZE A · FSCM NO. 05869 · DWG NO. 1950514 · REV
		.X ±0.5	APPD [signature] 78-09-06	SCALE NONE · WT · SHEET 1 OF 21
		ANGLES ±2°		



14.065 REF
1.0781
6.3115 ±0.0005
1.6762
6° +10° -0
7
0.65 MIN-TYP
R1
MT1
R2
MT2
5
5.76
8
10
STOCK
2.5 MIN
X -AXIS
4
DETAIL B SHEET 4
DETAIL D SHEET 12
DETAIL A SHEET 3
DETAIL C SHEET 1
METRIC
HUGHES AIRCRAFT COMPANY FULLERTON, CALIFORNIA
DR
ISSUED
CONTRACT:
SIZE A
FSCM NO. 05869
DWG NO. 1950514
REV
SCALE NONE
SHEET 2

FIGURE 1



DETAIL A
MTI
(TRANSDUCER)

NOTES:

31. FOR DIM S, X, & Y, SEE SHEETS 5 THRU 10.

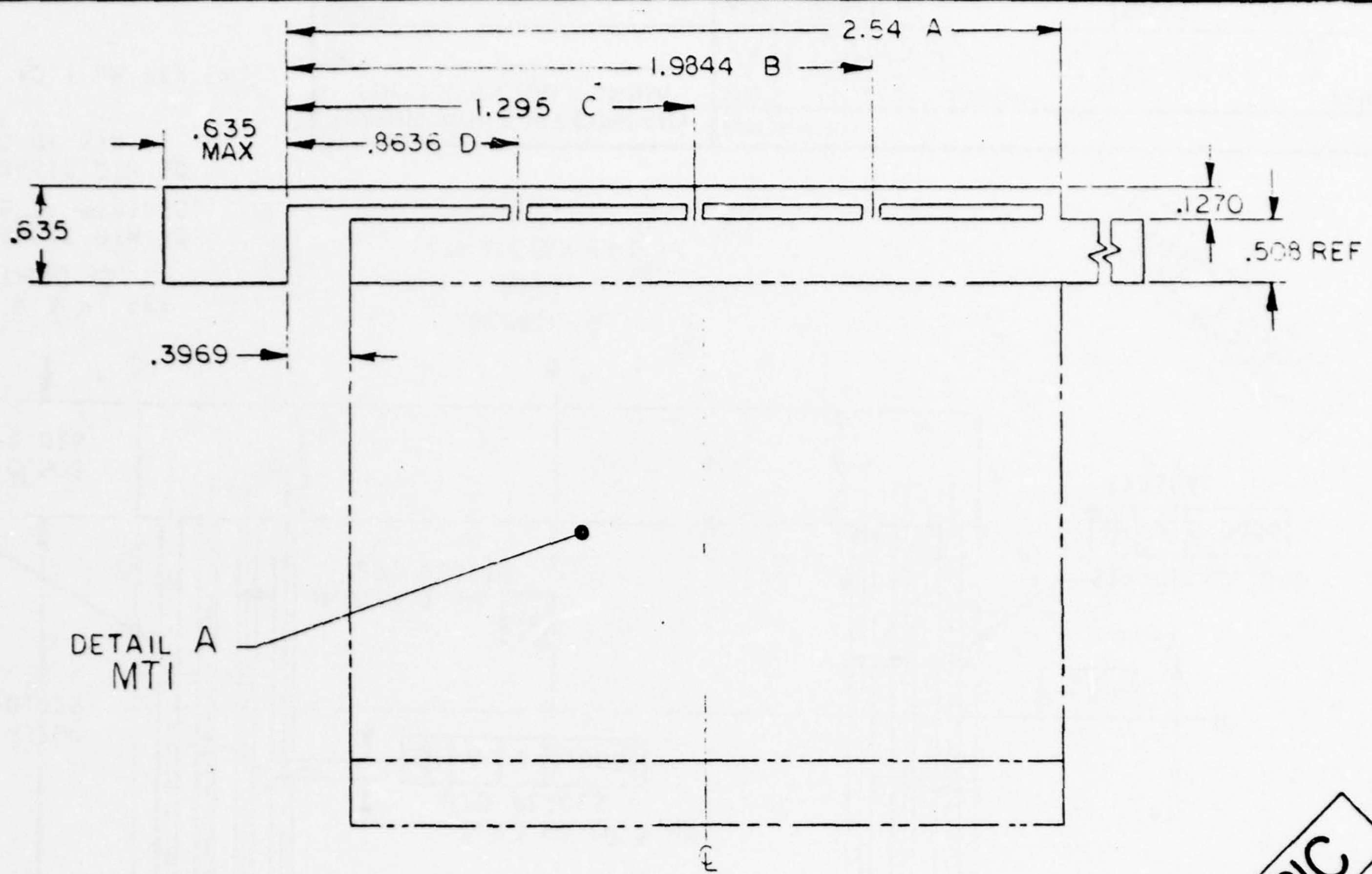
32. DIM X ARE BASIC DIM TO CENTERLINES OF STRIPES.

33. DIM Y ARE BASIC DIM TO CENTERLINES OF STRIPE BREAKS.

34 TOLERANCE: ±0.1 μm PER μm.

HUGHES AIRCRAFT COMPANY FULLERTON, CALIFORNIA	CONTRACT			
	SIZE A	FSCM NO. 05869	DWG NO. 1950514	REV
DR				
ISSUED	SCALE NONE		SHEET 3	

1950514



DETAIL B

(RESISTOR NETWORK)

R1

METRIC

TABULATION		
LENGTH	NO. OF SQ.	MATERIAL
A	158	AL CNDCT 2KA THK .02 WIDE
B	125	
C	9.6	
D	$\boxed{10}$	

HUGHES AIRCRAFT COMPANY FULLERTON, CALIFORNIA	CONTRACT			
DR	SIZE A	FSCM NO. 05869	DWG NO. 1950514	REV
ISSUED	SCALE NONE		SHEET 4	

STRIPE NO.	DIM X STRIPE LOCATION	DIM Y BREAK LOCATION	DIM S STRIPE WIDTH
1	-1.05845E 00	-1.27000E 00	3.93474E 00
2	-1.05058E 00	-1.27000E 00	3.93474E 00
3	-1.04271E 00	1.27000E 00	3.93474E 00
4	-1.03484E 00	1.27000E 00	3.93474E 00
5	-1.02697E 00	1.27000E 00	3.93474E 00
6	-1.01910E 00	1.27000E 00	3.93474E 00
7	-1.01123E 00	1.27000E 00	3.93474E 00
8	-1.00336E 00	1.27000E 00	3.93474E 00
9	-9.95491E-01	1.27000E 00	3.93474E 00
10	-9.87622E-01	1.27000E 00	3.93474E 00
11	-9.79752E-01	1.27000E 00	3.93474E 00
12	-9.71883E-01	1.27000E 00	3.93474E 00
13	-9.64013E-01	1.27000E 00	3.93474E 00
14	-9.56144E-01	1.27000E 00	3.93474E 00
15	-9.48274E-01	1.27000E 00	3.93474E 00
16	-9.40405E-01	1.27000E 00	3.93474E 00
17	-9.32535E-01	-1.27000E 00	3.93474E 00
18	-9.24666E-01	-1.27000E 00	3.93474E 00
19	-9.16796E-01	-1.27000E 00	3.93474E 00
20	-9.08927E-01	-1.27000E 00	3.93474E 00
21	-9.01057E-01	-1.27000E 00	3.93474E 00
22	-8.93188E-01	-1.27000E 00	3.93474E 00
23	-8.85318E-01	-1.27000E 00	3.93474E 00
24	-8.77449E-01	-1.27000E 00	3.93474E 00
25	-8.69579E-01	-1.27000E 00	3.93474E 00
26	-8.61710E-01	-1.27000E 00	3.93474E 00
27	-8.53840E-01	1.27000E 00	3.93474E 00
28	-8.45971E-01	1.27000E 00	3.93474E 00
29	-8.38101E-01	1.27000E 00	3.93474E 00
30	-8.30232E-01	1.27000E 00	3.93474E 00
31	-8.22362E-01	1.27000E 00	3.93474E 00
32	-8.14493E-01	1.27000E 00	3.93474E 00
33	-8.06623E-01	1.27000E 00	3.93474E 00
34	-7.98754E-01	1.27000E 00	3.93474E 00
35	-7.90884E-01	1.27000E 00	3.93474E 00
36	-7.83015E-01	1.27000E 00	3.93474E 00
37	-7.75145E-01	-1.27000E 00	3.93474E 00
38	-7.67276E-01	-1.27000E 00	3.93474E 00
39	-7.59406E-01	-1.27000E 00	3.93474E 00
40	-7.51537E-01	-1.27000E 00	3.93474E 00
41	-7.43667E-01	-1.27000E 00	3.93474E 00
42	-7.35798E-01	-1.27000E 00	3.93474E 00
43	-7.27928E-01	1.27000E 00	3.93474E 00
44	-7.20059E-01	1.27000E 00	3.93474E 00
45	-7.12189E-01	1.27000E 00	3.93474E 00
46	-7.04320E-01	1.27000E 00	3.93474E 00
47	-6.96450E-01	1.27000E 00	3.93474E 00
48	-6.88581E-01	1.27000E 00	3.93474E 00
49	-6.80711E-01	-1.27000E 00	3.93474E 00
50	-6.72842E-01	-1.27000E 00	3.93474E 00

TRANSDUCER NAME: ECOMMT BPQ UNAPODIZED HAMMING TRANSDUCER
DATE: JAN 20,1978
REF DES: MT1
TOTAL NUMBER OF ELECTRODE STRIPES: 270

SIZE	FSCM NO.	DRAWING NO.	REV
A	05869	1950514	
SCALE: NONE		SHEET	5

STRIPE NO.	DIM X STRIPE LOCATION	DIM Y BREAK LOCATION	DIM S STRIPE WIDTH
51	-6.64972E-01	1.27000E 00	3.93474E 00
52	-6.57103E-01	1.27000E 00	3.93474E 00
53	-6.49233E-01	1.27000E 00	3.93474E 00
54	-6.41364E-01	1.27000E 00	3.93474E 00
55	-6.33494E-01	1.27000E 00	3.93474E 00
56	-6.25625E-01	1.27000E 00	3.93474E 00
57	-6.17755E-01	-1.27000E 00	3.93474E 00
58	-6.09886E-01	-1.27000E 00	3.93474E 00
59	-6.02016E-01	-1.27000E 00	3.93474E 00
60	-5.94147E-01	-1.27000E 00	3.93474E 00
61	-5.86277E-01	-1.27000E 00	3.93474E 00
62	-5.78408E-01	-1.27000E 00	3.93474E 00
63	-5.70538E-01	1.27000E 00	3.93474E 00
64	-5.62669E-01	1.27000E 00	3.93474E 00
65	-5.54799E-01	-1.27000E 00	3.93474E 00
66	-5.46930E-01	-1.27000E 00	3.93474E 00
67	-5.39060E-01	1.27000E 00	3.93474E 00
68	-5.31191E-01	1.27000E 00	3.93474E 00
69	-5.23321E-01	1.27000E 00	3.93474E 00
70	-5.15452E-01	1.27000E 00	3.93474E 00
71	-5.07582E-01	1.27000E 00	3.93474E 00
72	-4.99713E-01	1.27000E 00	3.93474E 00
73	-4.91843E-01	-1.27000E 00	3.93474E 00
74	-4.83974E-01	-1.27000E 00	3.93474E 00
75	-4.76104E-01	1.27000E 00	3.93474E 00
76	-4.68235E-01	1.27000E 00	3.93474E 00
77	-4.60365E-01	-1.27000E 00	3.93474E 00
78	-4.52496E-01	-1.27000E 00	3.93474E 00
79	-4.44626E-01	1.27000E 00	3.93474E 00
80	-4.36757E-01	1.27000E 00	3.93474E 00
81	-4.28887E-01	1.27000E 00	3.93474E 00
82	-4.21018E-01	1.27000E 00	3.93474E 00
83	-4.13148E-01	1.27000E 00	3.93474E 00
84	-4.05279E-01	1.27000E 00	3.93474E 00
85	-3.97409E-01	-1.27000E 00	3.93474E 00
86	-3.89540E-01	-1.27000E 00	3.93474E 00
87	-3.81670E-01	1.27000E 00	3.93474E 00
88	-3.73801E-01	1.27000E 00	3.93474E 00
89	-3.65932E-01	-1.27000E 00	3.93474E 00
90	-3.58062E-01	-1.27000E 00	3.93474E 00
91	-3.50192E-01	1.27000E 00	3.93474E 00
92	-3.42323E-01	1.27000E 00	3.93474E 00
93	-3.34454E-01	-1.27000E 00	3.93474E 00
94	-3.26584E-01	-1.27000E 00	3.93474E 00
95	-3.18714E-01	1.27000E 00	3.93474E 00
96	-3.10845E-01	1.27000E 00	3.93474E 00
97	-3.02976E-01	-1.27000E 00	3.93474E 00
98	-2.95106E-01	-1.27000E 00	3.93474E 00
99	-2.87237E-01	1.27000E 00	3.93474E 00
100	-2.79367E-01	1.27000E 00	3.93474E 00

TRANSDUCER NAME: ECOMMT RPQ UNAPODIZED HAMMING TRANSDUCER
DATE: JAN 20,1978
REF DES: MT1
TOTAL NUMBER OF ELECTRODE STRIPES: 270

SIZE	FSCM NO.	DRAWING NO.	REV
A	05869	1950514	
SCALE: NONE		SHEET	6

STRIPE NO.	DIM X STRIPE LOCATION	DIM Y BREAK LOCATION	DIM S STRIPE WIDTH
101	-2.71498E-01	-1.27000E 00	3.93474E 00
102	-2.63628E-01	-1.27000E 00	3.93474E 00
103	-2.55759E-01	-1.27000E 00	3.93474E 00
104	-2.47889E-01	-1.27000E 00	3.93474E 00
105	-2.40020E-01	-1.27000E 00	3.93474E 00
106	-2.32150E-01	-1.27000E 00	3.93474E 00
107	-2.24281E-01	1.27000E 00	3.93474E 00
108	-2.16411E-01	1.27000E 00	3.93474E 00
109	-2.08542E-01	-1.27000E 00	3.93474E 00
110	-2.00672E-01	-1.27000E 00	3.93474E 00
111	-1.92803E-01	1.27000E 00	3.93474E 00
112	-1.84933E-01	1.27000E 00	3.93474E 00
113	-1.77064E-01	-1.27000E 00	3.93474E 00
114	-1.69194E-01	-1.27000E 00	3.93474E 00
115	-1.61325E-01	1.27000E 00	3.93474E 00
116	-1.53455E-01	1.27000E 00	3.93474E 00
117	-1.45586E-01	-1.27000E 00	3.93474E 00
118	-1.37716E-01	-1.27000E 00	3.93474E 00
119	-1.29847E-01	1.27000E 00	3.93474E 00
120	-1.21977E-01	1.27000E 00	3.93474E 00
121	-1.14108E-01	-1.27000E 00	3.93474E 00
122	-1.06238E-01	-1.27000E 00	3.93474E 00
123	-9.83686E-02	1.27000E 00	3.93474E 00
124	-9.04992E-02	1.27000E 00	3.93474E 00
125	-8.26297E-02	-1.27000E 00	3.93474E 00
126	-7.47602E-02	-1.27000E 00	3.93474E 00
127	-6.68907E-02	1.27000E 00	3.93474E 00
128	-5.90212E-02	1.27000E 00	3.93474E 00
129	-5.11517E-02	-1.27000E 00	3.93474E 00
130	-4.32822E-02	-1.27000E 00	3.93474E 00
131	-3.54127E-02	1.27000E 00	3.93474E 00
132	-2.75432E-02	1.27000E 00	3.93474E 00
133	-1.96737E-02	-1.27000E 00	3.93474E 00
134	-1.18042E-02	-1.27000E 00	3.93474E 00
135	-3.93474E-03	1.27000E 00	3.93474E 00
136	3.93474E-03	1.27000E 00	3.93474E 00
137	1.18042E-02	-1.27000E 00	3.93474E 00
138	1.96737E-02	-1.27000E 00	3.93474E 00
139	2.75432E-02	1.27000E 00	3.93474E 00
140	3.54127E-02	1.27000E 00	3.93474E 00
141	4.32822E-02	-1.27000E 00	3.93474E 00
142	5.11517E-02	-1.27000E 00	3.93474E 00
143	5.90212E-02	1.27000E 00	3.93474E 00
144	6.68907E-02	1.27000E 00	3.93474E 00
145	7.47602E-02	-1.27000E 00	3.93474E 00
146	8.26297E-02	-1.27000E 00	3.93474E 00
147	9.04992E-02	1.27000E 00	3.93474E 00
148	9.83686E-02	1.27000E 00	3.93474E 00
149	1.06238E-01	-1.27000E 00	3.93474E 00
150	1.14108E-01	-1.27000E 00	3.93474E 00

TRANSDUCER NAME: ECOMMT BPO UNAPODIZED HAMMING TRANSDUCER
DATE: JAN 20,1978
REF DES: MT1
TOTAL NUMBER OF ELECTRODE STRIPES: 270

SIZE	FSCM NO.	DRAWING NO.	REV
A	05869	1950514	
SCALE: NONE		SHEET	7

STRIPE NO.	DIM X STRIPE LOCATION	DIM Y BREAK LOCATION	DIM S STRIPE WIDTH
151	1.21977E-01	1.27000E 00	3.93474E 00
152	1.29847E-01	1.27000E 00	3.93474E 00
153	1.37716E-01	-1.27000E 00	3.93474E 00
154	1.45586E-01	-1.27000E 00	3.93474E 00
155	1.53455E-01	1.27000E 00	3.93474E 00
156	1.61325E-01	1.27000E 00	3.93474E 00
157	1.69194E-01	-1.27000E 00	3.93474E 00
158	1.77064E-01	-1.27000E 00	3.93474E 00
159	1.84933E-01	1.27000E 00	3.93474E 00
160	1.92803E-01	1.27000E 00	3.93474E 00
161	2.00672E-01	-1.27000E 00	3.93474E 00
162	2.08542E-01	-1.27000E 00	3.93474E 00
163	2.16411E-01	1.27000E 00	3.93474E 00
164	2.24281E-01	1.27000E 00	3.93474E 00
165	2.32150E-01	-1.27000E 00	3.93474E 00
166	2.40020E-01	-1.27000E 00	3.93474E 00
167	2.47889E-01	-1.27000E 00	3.93474E 00
168	2.55759E-01	-1.27000E 00	3.93474E 00
169	2.63628E-01	-1.27000E 00	3.93474E 00
170	2.71498E-01	-1.27000E 00	3.93474E 00
171	2.79367E-01	1.27000E 00	3.93474E 00
172	2.87237E-01	1.27000E 00	3.93474E 00
173	2.95106E-01	-1.27000E 00	3.93474E 00
174	3.02976E-01	-1.27000E 00	3.93474E 00
175	3.10845E-01	1.27000E 00	3.93474E 00
176	3.18714E-01	1.27000E 00	3.93474E 00
177	3.26584E-01	-1.27000E 00	3.93474E 00
178	3.34454E-01	-1.27000E 00	3.93474E 00
179	3.42323E-01	1.27000E 00	3.93474E 00
180	3.50192E-01	1.27000E 00	3.93474E 00
181	3.58062E-01	-1.27000E 00	3.93474E 00
182	3.65932E-01	-1.27000E 00	3.93474E 00
183	3.73801E-01	1.27000E 00	3.93474E 00
184	3.81670E-01	1.27000E 00	3.93474E 00
185	3.89540E-01	-1.27000E 00	3.93474E 00
186	3.97409E-01	-1.27000E 00	3.93474E 00
187	4.05279E-01	1.27000E 00	3.93474E 00
188	4.13148E-01	1.27000E 00	3.93474E 00
189	4.21018E-01	1.27000E 00	3.93474E 00
190	4.28887E-01	1.27000E 00	3.93474E 00
191	4.36757E-01	1.27000E 00	3.93474E 00
192	4.44626E-01	1.27000E 00	3.93474E 00
193	4.52496E-01	-1.27000E 00	3.93474E 00
194	4.60365E-01	-1.27000E 00	3.93474E 00
195	4.68235E-01	1.27000E 00	3.93474E 00
196	4.76104E-01	1.27000E 00	3.93474E 00
197	4.83974E-01	-1.27000E 00	3.93474E 00
198	4.91843E-01	-1.27000E 00	3.93474E 00
199	4.99713E-01	1.27000E 00	3.93474E 00
200	5.07582E-01	1.27000E 00	3.93474E 00

TRANSDUCER NAME: ECOMMT BPQ UNAPODIZED HAMMING TRANSDUCER
DATE: JAN 26,1978
REF DES: MT1
TOTAL NUMBER OF ELECTRODE STRIPES: 270

SIZE	FSCM NO.	DRAWING NO.	REV
A	05869	1950514	
SCALE: NONE		SHEET	8

STRIPE NO.	DIM X STRIPE LOCATION	DIM Y BREAK LOCATION	DIM S STRIPE WIDTH
201	5.15452E-01	1.27000E 00	3.93474E 00
202	5.23321E-01	1.27000E 00	3.93474E 00
203	5.31191E-01	1.27000E 00	3.93474E 00
204	5.39060E-01	1.27000E 00	3.93474E 00
205	5.46930E-01	-1.27000E 00	3.93474E 00
206	5.54799E-01	-1.27000E 00	3.93474E 00
207	5.62669E-01	1.27000E 00	3.93474E 00
208	5.70538E-01	1.27000E 00	3.93474E 00
209	5.78408E-01	-1.27000E 00	3.93474E 00
210	5.86277E-01	-1.27000E 00	3.93474E 00
211	5.94147E-01	-1.27000E 00	3.93474E 00
212	6.02016E-01	-1.27000E 00	3.93474E 00
213	6.09886E-01	-1.27000E 00	3.93474E 00
214	6.17755E-01	-1.27000E 00	3.93474E 00
215	6.25625E-01	1.27000E 00	3.93474E 00
216	6.33494E-01	1.27000E 00	3.93474E 00
217	6.41364E-01	1.27000E 00	3.93474E 00
218	6.49233E-01	1.27000E 00	3.93474E 00
219	6.57103E-01	1.27000E 00	3.93474E 00
220	6.64972E-01	1.27000E 00	3.93474E 00
221	6.72842E-01	-1.27000E 00	3.93474E 00
222	6.80711E-01	-1.27000E 00	3.93474E 00
223	6.88581E-01	1.27000E 00	3.93474E 00
224	6.96450E-01	1.27000E 00	3.93474E 00
225	7.04320E-01	1.27000E 00	3.93474E 00
226	7.12189E-01	1.27000E 00	3.93474E 00
227	7.20059E-01	1.27000E 00	3.93474E 00
228	7.27928E-01	1.27000E 00	3.93474E 00
229	7.35798E-01	-1.27000E 00	3.93474E 00
230	7.43667E-01	-1.27000E 00	3.93474E 00
231	7.51537E-01	-1.27000E 00	3.93474E 00
232	7.59406E-01	-1.27000E 00	3.93474E 00
233	7.67276E-01	-1.27000E 00	3.93474E 00
234	7.75145E-01	-1.27000E 00	3.93474E 00
235	7.83015E-01	1.27000E 00	3.93474E 00
236	7.90884E-01	1.27000E 00	3.93474E 00
237	7.98754E-01	1.27000E 00	3.93474E 00
238	8.06623E-01	1.27000E 00	3.93474E 00
239	8.14493E-01	1.27000E 00	3.93474E 00
240	8.22362E-01	1.27000E 00	3.93474E 00
241	8.30232E-01	1.27000E 00	3.93474E 00
242	8.38101E-01	1.27000E 00	3.93474E 00
243	8.45971E-01	1.27000E 00	3.93474E 00
244	8.53840E-01	1.27000E 00	3.93474E 00
245	8.61710E-01	-1.27000E 00	3.93474E 00
246	8.69579E-01	-1.27000E 00	3.93474E 00
247	8.77449E-01	-1.27000E 00	3.93474E 00
248	8.85318E-01	-1.27000E 00	3.93474E 00
249	8.93188E-01	-1.27000E 00	3.93474E 00
250	9.01057E-01	-1.27000E 00	3.93474E 00

TRANSDUCER NAME: ECOMMT BPO UNAPODIZED HAMMING TRANSDUCER
DATE: JAN 26,1978
REF DES: MT1
TOTAL NUMBER OF ELECTRODE STRIPES: 270

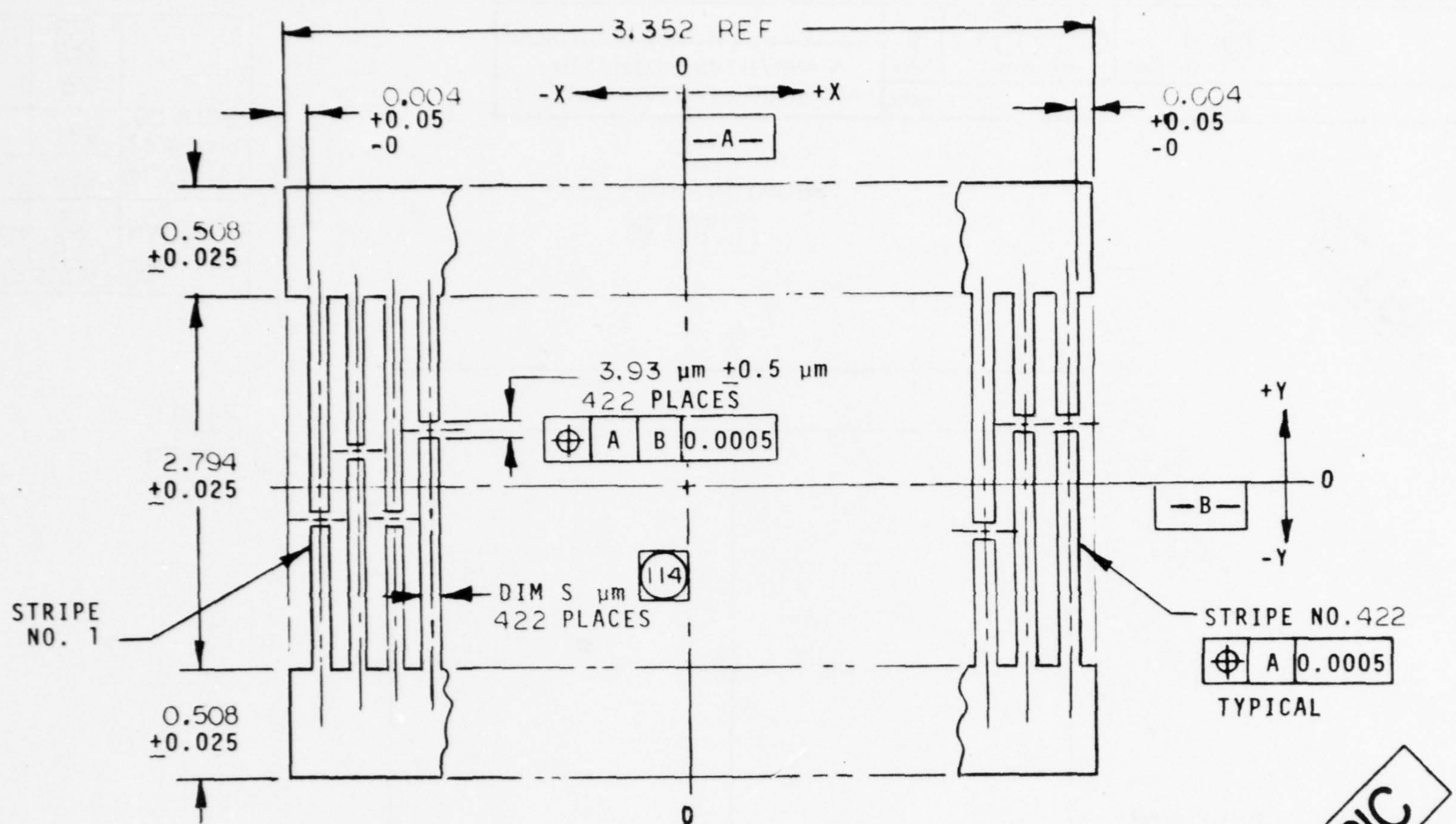
SIZE	FSCM NO.	DRAWING NO.	REV
A	05869	1950514	
SCALE: NONE		SHEET	9

STRIPE NO.	DIM X STRIPE LOCATION	DIM Y BREAK LOCATION	DIM S STRIPE WIDTH
251	9.08927E-01	-1.27000E 00	3.93474E 00
252	9.16796E-01	-1.27000E 00	3.93474E 00
253	9.24666E-01	-1.27000E 00	3.93474E 00
254	9.32535E-01	-1.27000E 00	3.93474E 00
255	9.40405E-01	1.27000E 00	3.93474E 00
256	9.48274E-01	1.27000E 00	3.93474E 00
257	9.56144E-01	1.27000E 00	3.93474E 00
258	9.64013E-01	1.27000E 00	3.93474E 00
259	9.71883E-01	1.27000E 00	3.93474E 00
260	9.79752E-01	1.27000E 00	3.93474E 00
261	9.87622E-01	1.27000E 00	3.93474E 00
262	9.95491E-01	1.27000E 00	3.93474E 00
263	1.00336E 00	1.27000E 00	3.93474E 00
264	1.01123E 00	1.27000E 00	3.93474E 00
265	1.01910E 00	1.27000E 00	3.93474E 00
266	1.02697E 00	1.27000E 00	3.93474E 00
267	1.03484E 00	1.27000E 00	3.93474E 00
268	1.04271E 00	1.27000E 00	3.93474E 00
269	1.05058E 00	-1.27000E 00	3.93474E 00
270	1.05845E 00	-1.27000E 00	3.93474E 00

TRANSDUCER NAME: ECOMMT BPQ UNAPODIZED HAMMING TRANSDUCER
DATE: JAN 20,1978
REF DES: MT1
TOTAL NUMBER OF ELECTRODE STRIPES: 270

SIZE	FSCM NO.	DRAWING NO.	REV
A	05869	1950514	
SCALE: NONE		SHEET	10

1950514



DETAIL C

MT2

(TRANSDUCER)

METRIC

NOTES:

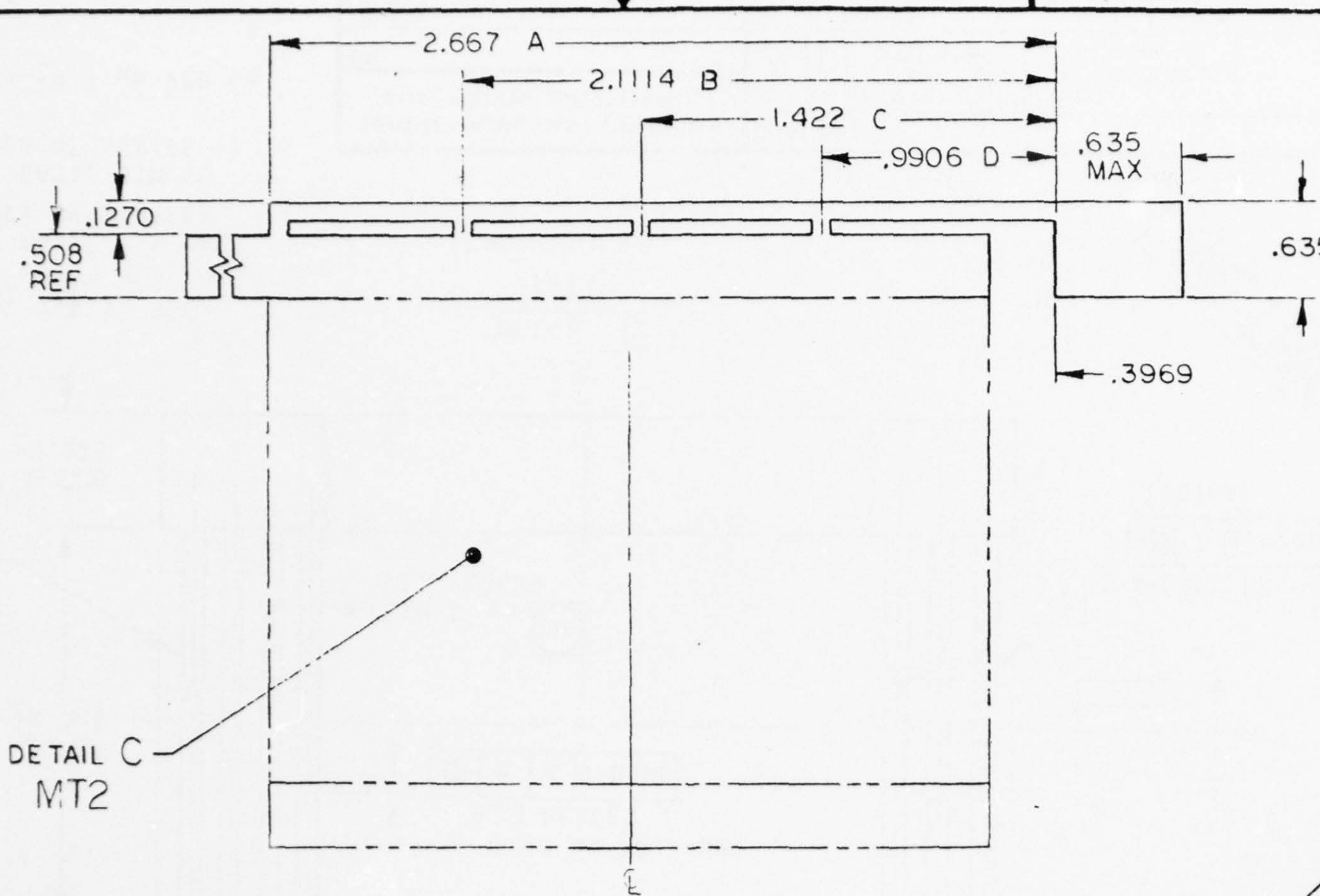
101. FOR DIM S, X, & Y, SEE SHEETS 13 THRU 21.

102. DIM X ARE BASIC DIM TO CENTERLINES OF STRIPES.

3. DIM Y ARE BASIC DIM TO CENTERLINES OF STRIPE BREAKS.

4. TOLERANCE: ±0.1 μm PER μm.

HUGHES AIRCRAFT COMPANY FULLERTON, CALIFORNIA	CONTRACT:			
	SIZE A	FSCM NO. 05869	DWG NO. 1950514	REV
DR				
ISSUED	SCALE NONE		SHEET 11	



DETAIL D
(RESISTOR NETWORK)
R2

METRIC

TABULATION		
LENGTH	NO. OF SQ	MATERIAL
A	158	AL CNDCT 2KA THK .02 WIDE
B	125	
C	9.6	
D	10	

HUGHES AIRCRAFT COMPANY FULLERTON, CALIFORNIA	CONTRACT			
DR	SIZE A	FSCM NO. 05869	DWG NO. 1950514	REV
ISSUED	SCALE NONE		SHEET 12	

STRIPE NO.	DIM X STRIPE LOCATION	DIM Y BREAK LOCATION	DIM S STRIPE WIDTH
1	-1.65653E 00	-1.24193E-02	3.93474E 00
2	-1.64866E 00	-1.24193E-02	3.93474E 00
3	-1.64079E 00	1.25984E-02	3.93474E 00
4	-1.63292E 00	1.25984E-02	3.93474E 00
5	-1.62505E 00	-1.30124E-02	3.93474E 00
6	-1.61718E 00	-1.30124E-02	3.93474E 00
7	-1.60931E 00	1.36639E-02	3.93474E 00
8	-1.60144E 00	1.36639E-02	3.93474E 00
9	-1.59357E 00	-1.45555E-02	3.93474E 00
10	-1.58570E 00	-1.45555E-02	3.93474E 00
11	-1.57783E 00	1.56858E-02	3.93474E 00
12	-1.56996E 00	1.56858E-02	3.93474E 00
13	-1.56209E 00	-1.70574E-02	3.93474E 00
14	-1.55422E 00	-1.70574E-02	3.93474E 00
15	-1.54636E 00	1.86665E-02	3.93474E 00
16	-1.53849E 00	1.86665E-02	3.93474E 00
17	-1.53062E 00	-2.05130E-02	3.93474E 00
18	-1.52275E 00	-2.05130E-02	3.93474E 00
19	-1.51488E 00	2.25920E-02	3.93474E 00
20	-1.50701E 00	2.25920E-02	3.93474E 00
21	-1.49914E 00	-2.49009E-02	3.93474E 00
22	-1.49127E 00	-2.49009E-02	3.93474E 00
23	-1.48340E 00	2.74345E-02	3.93474E 00
24	-1.47553E 00	2.74345E-02	3.93474E 00
25	-1.46766E 00	-3.01853E-02	3.93474E 00
26	-1.45979E 00	-3.01853E-02	3.93474E 00
27	-1.45192E 00	3.31444E-02	3.93474E 00
28	-1.44405E 00	3.31444E-02	3.93474E 00
29	-1.43618E 00	-3.63055E-02	3.93474E 00
30	-1.42831E 00	-3.63055E-02	3.93474E 00
31	-1.42044E 00	3.96557E-02	3.93474E 00
32	-1.41257E 00	3.96557E-02	3.93474E 00
33	-1.40470E 00	-4.31825E-02	3.93474E 00
34	-1.39684E 00	-4.31825E-02	3.93474E 00
35	-1.38897E 00	4.68744E-02	3.93474E 00
36	-1.38110E 00	4.68744E-02	3.93474E 00
37	-1.37323E 00	-5.07149E-02	3.93474E 00
38	-1.36536E 00	-5.07149E-02	3.93474E 00
39	-1.35749E 00	5.46849E-02	3.93474E 00
40	-1.34962E 00	5.46849E-02	3.93474E 00
41	-1.34175E 00	-5.87692E-02	3.93474E 00
42	-1.33388E 00	-5.87692E-02	3.93474E 00
43	-1.32601E 00	6.29424E-02	3.93474E 00
44	-1.31814E 00	6.29424E-02	3.93474E 00
45	-1.31027E 00	-6.71855E-02	3.93474E 00
46	-1.30240E 00	-6.71855E-02	3.93474E 00
47	-1.29453E 00	7.14718E-02	3.93474E 00
48	-1.28666E 00	7.14718E-02	3.93474E 00
49	-1.27879E 00	-7.57745E-02	3.93474E 00
50	-1.27092E 00	-7.57745E-02	3.93474E 00

TRANSDUCER NAME: ECOMMT BPG APODIZED VASILE TRANSDUCER
DATE: JAN 20,1978
REF DES: MT2
TOTAL NUMBER OF ELECTRODE STRIPES: 422

SIZE	FSCM NO.	DRAWING NO.	REV
A	05869	1950514	
SCALE: NONE		SHEET	13

STRIPE NO.	DIM X STRIPE LOCATION	DIM Y BREAK LOCATION	DIM S STRIPE WIDTH
51	-1.26305E 00	8.00645E-02	3.93474E 00
52	-1.25518E 00	8.00645E-02	3.93474E 00
53	-1.24731E 00	-8.43126E-02	3.93474E 00
54	-1.23944E 00	-8.43126E-02	3.93474E 00
55	-1.23158E 00	8.84845E-02	3.93474E 00
56	-1.22371E 00	8.84845E-02	3.93474E 00
57	-1.21584E 00	-9.25447E-02	3.93474E 00
58	-1.20797E 00	-9.25447E-02	3.93474E 00
59	-1.20010E 00	9.64589E-02	3.93474E 00
60	-1.19223E 00	9.64589E-02	3.93474E 00
61	-1.18436E 00	-1.00186E-01	3.93474E 00
62	-1.17649E 00	-1.00186E-01	3.93474E 00
63	-1.16862E 00	1.03688E-01	3.93474E 00
64	-1.16075E 00	1.03688E-01	3.93474E 00
65	-1.15288E 00	-1.06920E-01	3.93474E 00
66	-1.14501E 00	-1.06920E-01	3.93474E 00
67	-1.13714E 00	1.09840E-01	3.93474E 00
68	-1.12927E 00	1.09840E-01	3.93474E 00
69	-1.12140E 00	-1.12401E-01	3.93474E 00
70	-1.11353E 00	-1.12401E-01	3.93474E 00
71	-1.10566E 00	1.14560E-01	3.93474E 00
72	-1.09779E 00	1.14560E-01	3.93474E 00
73	-1.08992E 00	-1.16267E-01	3.93474E 00
74	-1.08206E 00	-1.16267E-01	3.93474E 00
75	-1.07419E 00	1.17475E-01	3.93474E 00
76	-1.06632E 00	1.17475E-01	3.93474E 00
77	-1.05845E 00	-1.18133E-01	3.93474E 00
78	-1.05058E 00	-1.18133E-01	3.93474E 00
79	-1.04271E 00	1.18194E-01	3.93474E 00
80	-1.03484E 00	1.18194E-01	3.93474E 00
81	-1.02697E 00	-1.17606E-01	3.93474E 00
82	-1.01910E 00	-1.17606E-01	3.93474E 00
83	-1.01123E 00	1.16320E-01	3.93474E 00
84	-1.00336E 00	1.16320E-01	3.93474E 00
85	-9.95491E-01	-1.14288E-01	3.93474E 00
86	-9.87622E-01	-1.14288E-01	3.93474E 00
87	-9.79752E-01	1.11462E-01	3.93474E 00
88	-9.71883E-01	1.11462E-01	3.93474E 00
89	-9.64013E-01	-1.07791E-01	3.93474E 00
90	-9.56144E-01	-1.07791E-01	3.93474E 00
91	-9.48274E-01	1.03231E-01	3.93474E 00
92	-9.40405E-01	1.03231E-01	3.93474E 00
93	-9.32535E-01	-9.77365E-02	3.93474E 00
94	-9.24666E-01	-9.77365E-02	3.93474E 00
95	-9.16796E-01	9.12633E-02	3.93474E 00
96	-9.08927E-01	9.12633E-02	3.93474E 00
97	-9.01057E-01	-8.37728E-02	3.93474E 00
98	-8.93188E-01	-8.37728E-02	3.93474E 00
99	-8.85318E-01	7.52246E-02	3.93474E 00
100	-8.77449E-01	7.52246E-02	3.93474E 00

TRANSDUCER NAME: ECOMMT BPG AFCDIZED VASILE TRANSDUCER
DATE: JAN 20,1978
REF DES: MT2
TOTAL NUMBER OF ELECTRODE STRIPES: 422

SIZE	FSCM NO.	DRAWING NO.	REV
A	05869	1950514	
SCALE: NONE		SHEET	14

STRIPE NO.	DIM X STRIPE LOCATION	DIM Y BREAK LOCATION	DIM S STRIPE WIDTH
101	-8.69579E-01	-6.55840E-02	3.93474E 00
102	-8.61710E-01	-6.55840E-02	3.93474E 00
103	-8.53840E-01	5.48195E-02	3.93474E 00
104	-8.45971E-01	5.48195E-02	3.93474E 00
105	-8.38101E-01	-4.29019E-02	3.93474E 00
106	-8.30232E-01	-4.29019E-02	3.93474E 00
107	-8.22362E-01	2.98056E-02	3.93474E 00
108	-8.14493E-01	2.98056E-02	3.93474E 00
109	-8.06623E-01	-1.55105E-02	3.93474E 00
110	-7.98754E-01	-1.55105E-02	3.93474E 00
111	-7.90884E-01	0.0	3.93474E 00
112	-7.83015E-01	0.0	3.93474E 00
113	-7.75145E-01	1.67386E-02	3.93474E 00
114	-7.67276E-01	1.67386E-02	3.93474E 00
115	-7.59406E-01	-3.47116E-02	3.93474E 00
116	-7.51537E-01	-3.47116E-02	3.93474E 00
117	-7.43667E-01	5.39204E-02	3.93474E 00
118	-7.35798E-01	5.39204E-02	3.93474E 00
119	-7.27928E-01	-7.43635E-02	3.93474E 00
120	-7.20059E-01	-7.43635E-02	3.93474E 00
121	-7.12189E-01	9.60297E-02	3.93474E 00
122	-7.04320E-01	9.60297E-02	3.93474E 00
123	-6.96450E-01	-1.18906E-01	3.93474E 00
124	-6.88581E-01	-1.18906E-01	3.93474E 00
125	-6.80711E-01	1.42971E-01	3.93474E 00
126	-6.72842E-01	1.42971E-01	3.93474E 00
127	-6.64972E-01	-1.68199E-01	3.93474E 00
128	-6.57103E-01	-1.68199E-01	3.93474E 00
129	-6.49233E-01	1.94557E-01	3.93474E 00
130	-6.41364E-01	1.94557E-01	3.93474E 00
131	-6.33494E-01	-2.22010E-01	3.93474E 00
132	-6.25625E-01	-2.22010E-01	3.93474E 00
133	-6.17755E-01	2.50510E-01	3.93474E 00
134	-6.09886E-01	2.50510E-01	3.93474E 00
135	-6.02016E-01	-2.80010E-01	3.93474E 00
136	-5.94147E-01	-2.80010E-01	3.93474E 00
137	-5.86277E-01	3.10451E-01	3.93474E 00
138	-5.78408E-01	3.10451E-01	3.93474E 00
139	-5.70538E-01	-3.41775E-01	3.93474E 00
140	-5.62669E-01	-3.41775E-01	3.93474E 00
141	-5.54799E-01	3.73913E-01	3.93474E 00
142	-5.46930E-01	3.73913E-01	3.93474E 00
143	-5.39060E-01	-4.06792E-01	3.93474E 00
144	-5.31191E-01	-4.06792E-01	3.93474E 00
145	-5.23321E-01	4.40336E-01	3.93474E 00
146	-5.15452E-01	4.40336E-01	3.93474E 00
147	-5.07582E-01	-4.74460E-01	3.93474E 00
148	-4.99713E-01	-4.74460E-01	3.93474E 00
149	-4.91843E-01	5.09079E-01	3.93474E 00
150	-4.83974E-01	5.09079E-01	3.93474E 00

TRANSDUCER NAME: ECOMMT BPG APODIZED VASILE TRANSDUCER
DATE: JAN 20,1978
REF DES: MT2
TOTAL NUMBER OF ELECTRODE STRIPES: 422

SIZE	FSCM NO.	DRAWING NO.	REV
A	05869	1950514	
SCALE: NONE		SHEET	15

STRIPE NO.	DIM X STRIPE LOCATION	DIM Y BREAK LOCATION	DIM S STRIPE WIDTH
151	-4.76104E-01	-5.44100E-01	3.93474E 00
152	-4.68235E-01	-5.44100E-01	3.93474E 00
153	-4.60365E-01	5.79426E-01	3.93474E 00
154	-4.52496E-01	5.79426E-01	3.93474E 00
155	-4.44626E-01	-6.14959E-01	3.93474E 00
156	-4.36757E-01	-6.14959E-01	3.93474E 00
157	-4.28887E-01	6.50597E-01	3.93474E 00
158	-4.21018E-01	6.50597E-01	3.93474E 00
159	-4.13148E-01	-6.86234E-01	3.93474E 00
160	-4.05279E-01	-6.86234E-01	3.93474E 00
161	-3.97409E-01	7.21761E-01	3.93474E 00
162	-3.89540E-01	7.21761E-01	3.93474E 00
163	-3.81670E-01	-7.57068E-01	3.93474E 00
164	-3.73801E-01	-7.57068E-01	3.93474E 00
165	-3.65932E-01	7.92047E-01	3.93474E 00
166	-3.58062E-01	7.92047E-01	3.93474E 00
167	-3.50192E-01	-8.26582E-01	3.93474E 00
168	-3.42323E-01	-8.26582E-01	3.93474E 00
169	-3.34454E-01	8.60563E-01	3.93474E 00
170	-3.26584E-01	8.60563E-01	3.93474E 00
171	-3.18714E-01	-8.93875E-01	3.93474E 00
172	-3.10845E-01	-8.93875E-01	3.93474E 00
173	-3.02976E-01	9.26410E-01	3.93474E 00
174	-2.95106E-01	9.26410E-01	3.93474E 00
175	-2.87237E-01	-9.58055E-01	3.93474E 00
176	-2.79367E-01	-9.58055E-01	3.93474E 00
177	-2.71498E-01	9.88700E-01	3.93474E 00
178	-2.63628E-01	9.88700E-01	3.93474E 00
179	-2.55759E-01	-1.01824E 00	3.93474E 00
180	-2.47889E-01	-1.01824E 00	3.93474E 00
181	-2.40020E-01	1.04657E 00	3.93474E 00
182	-2.32150E-01	1.04657E 00	3.93474E 00
183	-2.24281E-01	-1.07360E 00	3.93474E 00
184	-2.16411E-01	-1.07360E 00	3.93474E 00
185	-2.08542E-01	1.09921E 00	3.93474E 00
186	-2.00672E-01	1.09921E 00	3.93474E 00
187	-1.92803E-01	-1.12333E 00	3.93474E 00
188	-1.84933E-01	-1.12333E 00	3.93474E 00
189	-1.77064E-01	1.14587E 00	3.93474E 00
190	-1.69194E-01	1.14587E 00	3.93474E 00
191	-1.61325E-01	-1.16673E 00	3.93474E 00
192	-1.53455E-01	-1.16673E 00	3.93474E 00
193	-1.45586E-01	1.18585E 00	3.93474E 00
194	-1.37716E-01	1.18585E 00	3.93474E 00
195	-1.29847E-01	-1.20315E 00	3.93474E 00
196	-1.21977E-01	-1.20315E 00	3.93474E 00
197	-1.14108E-01	1.21858E 00	3.93474E 00
198	-1.06238E-01	1.21858E 00	3.93474E 00
199	-9.83686E-02	-1.23207E 00	3.93474E 00
200	-9.04992E-02	-1.23207E 00	3.93474E 00

TRANSDUCER NAME: ECOMMT PPQ APODIZED VASILE TRANSDUCER
DATE: JAN 20,1978
REF DES: MT2
TOTAL NUMBER OF ELECTRODE STRIPES: 422

SIZE	FSCM NO.	DRAWING NO.	REV
A	05869	1950514	
SCALE: NONE		SHEET	16

STRIPE NO.	DIM X STRIPE LOCATION	DIM Y BREAK LOCATION	DIM S STRIPE WIDTH
201	-8.26297E-02	1.24356E 00	3.93474E 00
202	-7.47602E-02	1.24356E 00	3.93474E 00
203	-6.68907E-02	-1.25303E 00	3.93474E 00
204	-5.90212E-02	-1.25303E 00	3.93474E 00
205	-5.11517E-02	1.26043E 00	3.93474E 00
206	-4.32822E-02	1.26043E 00	3.93474E 00
207	-3.54127E-02	-1.26574E 00	3.93474E 00
208	-2.75432E-02	-1.26574E 00	3.93474E 00
209	-1.96737E-02	1.26893E 00	3.93474E 00
210	-1.18042E-02	1.26893E 00	3.93474E 00
211	-3.93474E-03	-1.27000E 00	3.93474E 00
212	3.93474E-03	-1.27000E 00	3.93474E 00
213	1.18042E-02	1.26893E 00	3.93474E 00
214	1.96737E-02	1.26893E 00	3.93474E 00
215	2.75432E-02	-1.26574E 00	3.93474E 00
216	3.54127E-02	-1.26574E 00	3.93474E 00
217	4.32822E-02	1.26043E 00	3.93474E 00
218	5.11517E-02	1.26043E 00	3.93474E 00
219	5.90212E-02	-1.25303E 00	3.93474E 00
220	6.68907E-02	-1.25303E 00	3.93474E 00
221	7.47602E-02	1.24356E 00	3.93474E 00
222	8.26297E-02	1.24356E 00	3.93474E 00
223	9.04992E-02	-1.23207E 00	3.93474E 00
224	9.83686E-02	-1.23207E 00	3.93474E 00
225	1.06238E-01	1.21858E 00	3.93474E 00
226	1.14108E-01	1.21858E 00	3.93474E 00
227	1.21977E-01	-1.20315E 00	3.93474E 00
228	1.29847E-01	-1.20315E 00	3.93474E 00
229	1.37716E-01	1.18585E 00	3.93474E 00
230	1.45586E-01	1.18585E 00	3.93474E 00
231	1.53455E-01	-1.16673E 00	3.93474E 00
232	1.61325E-01	-1.16673E 00	3.93474E 00
233	1.69194E-01	1.14587E 00	3.93474E 00
234	1.77064E-01	1.14587E 00	3.93474E 00
235	1.84933E-01	-1.12333E 00	3.93474E 00
236	1.92803E-01	-1.12333E 00	3.93474E 00
237	2.00672E-01	1.09921E 00	3.93474E 00
238	2.08542E-01	1.09921E 00	3.93474E 00
239	2.16411E-01	-1.07360E 00	3.93474E 00
240	2.24281E-01	-1.07360E 00	3.93474E 00
241	2.32150E-01	1.04657E 00	3.93474E 00
242	2.40020E-01	1.04657E 00	3.93474E 00
243	2.47889E-01	-1.01824E 00	3.93474E 00
244	2.55759E-01	-1.01824E 00	3.93474E 00
245	2.63628E-01	9.88700E-01	3.93474E 00
246	2.71498E-01	9.88700E-01	3.93474E 00
247	2.79367E-01	-9.58055E-01	3.93474E 00
248	2.87237E-01	-9.58055E-01	3.93474E 00
249	2.95106E-01	9.26410E-01	3.93474E 00
250	3.02976E-01	9.26410E-01	3.93474E 00

TRANSDUCER NAME: ECOMMT BPQ APODIZED VASILE TRANSDUCER
DATE: JAN 20,1978
REF DES: MT2
TOTAL NUMBER OF ELECTRODE STRIPES: 422

SIZE	FSCM NO.	DRAWING NO.	REV
A	05869	1950514	
SCALE: NONE		SHEET	17

STRIPE NO.	DIM X STRIPE LOCATION	DIM Y BREAK LOCATION	DIM S STRIPE WIDTH
251	3.10845E-01	-8.93875E-01	3.93474E 00
252	3.18714E-01	-8.93875E-01	3.93474E 00
253	3.26584E-01	8.60563E-01	3.93474E 00
254	3.34454E-01	8.60563E-01	3.93474E 00
255	3.42323E-01	-8.26582E-01	3.93474E 00
256	3.50192E-01	-8.26582E-01	3.93474E 00
257	3.58062E-01	7.92047E-01	3.93474E 00
258	3.65932E-01	7.92047E-01	3.93474E 00
259	3.73801E-01	-7.57068E-01	3.93474E 00
260	3.81670E-01	-7.57068E-01	3.93474E 00
261	3.89540E-01	7.21761E-01	3.93474E 00
262	3.97409E-01	7.21761E-01	3.93474E 00
263	4.05279E-01	-6.86234E-01	3.93474E 00
264	4.13148E-01	-6.86234E-01	3.93474E 00
265	4.21018E-01	6.50597E-01	3.93474E 00
266	4.28887E-01	6.50597E-01	3.93474E 00
267	4.36757E-01	-6.14959E-01	3.93474E 00
268	4.44626E-01	-6.14959E-01	3.93474E 00
269	4.52496E-01	5.79426E-01	3.93474E 00
270	4.60365E-01	5.79426E-01	3.93474E 00
271	4.68235E-01	-5.44100E-01	3.93474E 00
272	4.76104E-01	-5.44100E-01	3.93474E 00
273	4.83974E-01	5.09079E-01	3.93474E 00
274	4.91843E-01	5.09079E-01	3.93474E 00
275	4.99713E-01	-4.74460E-01	3.93474E 00
276	5.07582E-01	-4.74460E-01	3.93474E 00
277	5.15452E-01	4.40336E-01	3.93474E 00
278	5.23321E-01	4.40336E-01	3.93474E 00
279	5.31191E-01	-4.06792E-01	3.93474E 00
280	5.39060E-01	-4.06792E-01	3.93474E 00
281	5.46930E-01	3.73913E-01	3.93474E 00
282	5.54799E-01	3.73913E-01	3.93474E 00
283	5.62669E-01	-3.41775E-01	3.93474E 00
284	5.70538E-01	-3.41775E-01	3.93474E 00
285	5.78408E-01	3.10451E-01	3.93474E 00
286	5.86277E-01	3.10451E-01	3.93474E 00
287	5.94147E-01	-2.80010E-01	3.93474E 00
288	6.02016E-01	-2.80010E-01	3.93474E 00
289	6.09886E-01	2.50510E-01	3.93474E 00
290	6.17755E-01	2.50510E-01	3.93474E 00
291	6.25625E-01	-2.22010E-01	3.93474E 00
292	6.33494E-01	-2.22010E-01	3.93474E 00
293	6.41364E-01	1.94557E-01	3.93474E 00
294	6.49233E-01	1.94557E-01	3.93474E 00
295	6.57103E-01	-1.68199E-01	3.93474E 00
296	6.64972E-01	-1.68199E-01	3.93474E 00
297	6.72842E-01	1.42971E-01	3.93474E 00
298	6.80711E-01	1.42971E-01	3.93474E 00
299	6.88581E-01	-1.18906E-01	3.93474E 00
300	6.96450E-01	-1.18906E-01	3.93474E 00

TRANSDUCER NAME: ECOMMT RPQ APODIZED VASILE TRANSDUCER
DATE: JAN 20,1978
REF DES: MT2
TOTAL NUMBER OF ELECTRODE STRIPES: 422

SIZE	FSCM NO.	DRAWING NO.	REV
A	05869	19E0514	
SCALE: NONE		SHEET	18

STRIPE NO.	DIM $\overline{X}$ STRIPE LOCATION	DIM Y BREAK LOCATION	DIM S STRIPE WIDTH
301	7.04320E-01	9.60297E-02	3.93474E 00
302	7.12189E-01	9.60297E-02	3.93474E 00
303	7.20059E-01	-7.43635E-02	3.93474E 00
304	7.27928E-01	-7.43635E-02	3.93474E 00
305	7.35798E-01	5.39204E-02	3.93474E 00
306	7.43667E-01	5.39204E-02	3.93474E 00
307	7.51537E-01	-3.47116E-02	3.93474E 00
308	7.59406E-01	-3.47116E-02	3.93474E 00
309	7.67276E-01	1.67386E-02	3.93474E 00
310	7.75145E-01	1.67386E-02	3.93474E 00
311	7.83015E-01	0.0	3.93474E 00
312	7.90884E-01	0.0	3.93474E 00
313	7.98754E-01	-1.55105E-02	3.93474E 00
314	8.06623E-01	-1.55105E-02	3.93474E 00
315	8.14493E-01	2.98056E-02	3.93474E 00
316	8.22362E-01	2.98056E-02	3.93474E 00
317	8.30232E-01	-4.29019E-02	3.93474E 00
318	8.38101E-01	-4.29019E-02	3.93474E 00
319	8.45971E-01	5.48195E-02	3.93474E 00
320	8.53840E-01	5.48195E-02	3.93474E 00
321	8.61710E-01	-6.55840E-02	3.93474E 00
322	8.69579E-01	-6.55840E-02	3.93474E 00
323	8.77449E-01	7.52246E-02	3.93474E 00
324	8.85318E-01	7.52246E-02	3.93474E 00
325	8.93188E-01	-8.37728E-02	3.93474E 00
326	9.01057E-01	-8.37728E-02	3.93474E 00
327	9.08927E-01	9.12633E-02	3.93474E 00
328	9.16796E-01	9.12633E-02	3.93474E 00
329	9.24666E-01	-9.77365E-02	3.93474E 00
330	9.32535E-01	-9.77365E-02	3.93474E 00
331	9.40405E-01	1.03231E-01	3.93474E 00
332	9.48274E-01	1.03231E-01	3.93474E 00
333	9.56144E-01	-1.07791E-01	3.93474E 00
334	9.64013E-01	-1.07791E-01	3.93474E 00
335	9.71883E-01	1.11462E-01	3.93474E 00
336	9.79752E-01	1.11462E-01	3.93474E 00
337	9.87622E-01	-1.14288E-01	3.93474E 00
338	9.95491E-01	-1.14288E-01	3.93474E 00
339	1.00336E 00	1.16320E-01	3.93474E 00
340	1.01123E 00	1.16320E-01	3.93474E 00
341	1.01910E 00	-1.17606E-01	3.93474E 00
342	1.02697E 00	-1.17606E-01	3.93474E 00
343	1.03484E 00	1.18194E-01	3.93474E 00
344	1.04271E 00	1.18194E-01	3.93474E 00
345	1.05058E 00	-1.18133E-01	3.93474E 00
346	1.05845E 00	-1.18133E-01	3.93474E 00
347	1.06632E 00	1.17475E-01	3.93474E 00
348	1.07419E 00	1.17475E-01	3.93474E 00
349	1.08206E 00	-1.16267E-01	3.93474E 00
350	1.08992E 00	-1.16267E-01	3.93474E 00

TRANSDUCER NAME: ECOMMT BPQ APODIZED VASILE TRANSDUCER
DATE: JAN 20,1978
REF DES: MT2
TOTAL NUMBER OF ELECTRODE STRIPES: 422

SIZE	FSCM NO.	DRAWING NO.	REV
A	05869	1950514	
SCALE: NONE		SHEET 19	

STRIPE NO.	DIM X STRIPE LOCATION	DIM Y BREAK LOCATION	DIM S STRIPE WIDTH
351	1.09779E 00	1.14560E-01	3.93474E 00
352	1.10566E 00	1.14560E-01	3.93474E 00
353	1.11353E 00	-1.12401E-01	3.93474E 00
354	1.12140E 00	-1.12401E-01	3.93474E 00
355	1.12927E 00	1.09840E-01	3.93474E 00
356	1.13714E 00	1.09840E-01	3.93474E 00
357	1.14501E 00	-1.06920E-01	3.93474E 00
358	1.15288E 00	-1.06920E-01	3.93474E 00
359	1.16075E 00	1.03688E-01	3.93474E 00
360	1.16862E 00	1.03688E-01	3.93474E 00
361	1.17649E 00	-1.00186E-01	3.93474E 00
362	1.18436E 00	-1.00186E-01	3.93474E 00
363	1.19223E 00	9.64589E-02	3.93474E 00
364	1.20010E 00	9.64589E-02	3.93474E 00
365	1.20797E 00	-9.25447E-02	3.93474E 00
366	1.21584E 00	-9.25447E-02	3.93474E 00
367	1.22371E 00	8.84845E-02	3.93474E 00
368	1.23158E 00	8.84845E-02	3.93474E 00
369	1.23944E 00	-8.43126E-02	3.93474E 00
370	1.24731E 00	-8.43126E-02	3.93474E 00
371	1.25518E 00	8.00645E-02	3.93474E 00
372	1.26305E 00	8.00645E-02	3.93474E 00
373	1.27092E 00	-7.57745E-02	3.93474E 00
374	1.27879E 00	-7.57745E-02	3.93474E 00
375	1.28666E 00	7.14718E-02	3.93474E 00
376	1.29453E 00	7.14718E-02	3.93474E 00
377	1.30240E 00	-6.71855E-02	3.93474E 00
378	1.31027E 00	-6.71855E-02	3.93474E 00
379	1.31814E 00	6.29424E-02	3.93474E 00
380	1.32601E 00	6.29424E-02	3.93474E 00
381	1.33388E 00	-5.87692E-02	3.93474E 00
382	1.34175E 00	-5.87692E-02	3.93474E 00
383	1.34962E 00	5.46849E-02	3.93474E 00
384	1.35749E 00	5.46849E-02	3.93474E 00
385	1.36536E 00	-5.07149E-02	3.93474E 00
386	1.37323E 00	-5.07149E-02	3.93474E 00
387	1.38110E 00	4.68744E-02	3.93474E 00
388	1.38897E 00	4.68744E-02	3.93474E 00
389	1.39684E 00	-4.31825E-02	3.93474E 00
390	1.40470E 00	-4.31825E-02	3.93474E 00
391	1.41257E 00	3.96557E-02	3.93474E 00
392	1.42044E 00	3.96557E-02	3.93474E 00
393	1.42831E 00	-3.63055E-02	3.93474E 00
394	1.43618E 00	-3.63055E-02	3.93474E 00
395	1.44405E 00	3.31444E-02	3.93474E 00
396	1.45192E 00	3.31444E-02	3.93474E 00
397	1.45979E 00	-3.01853E-02	3.93474E 00
398	1.46766E 00	-3.01853E-02	3.93474E 00
399	1.47553E 00	2.74345E-02	3.93474E 00
400	1.48340E 00	2.74345E-02	3.93474E 00

TRANSDUCER NAME: ECOMMT BPQ APODIZED VASILE TRANSDUCER
DATE: JAN 20,1978
REF DES: MT2
TOTAL NUMBER OF ELECTRODE STRIPES: 422

SIZE	FSCM NO.	DRAWING NO.	REV
A	05869	1950514	
SCALE: NONE		SHEET	20

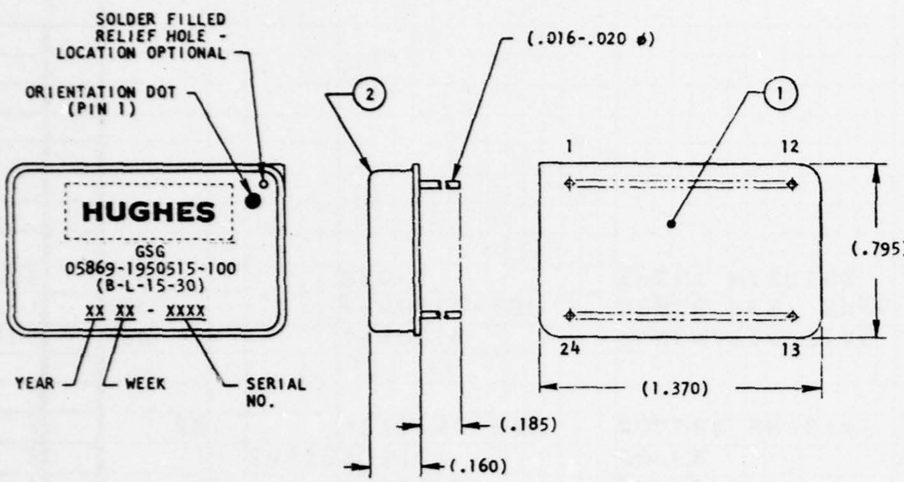
STRIPE NO.	DIM X STRIPE LOCATION	DIM Y BREAK LOCATION	DIM S STRIPE WIDTH
401	1.49127E 00	-2.49009E-02	3.93474E 00
402	1.49914E 00	-2.49009E-02	3.93474E 00
403	1.50701E 00	2.25920E-02	3.93474E 00
404	1.51488E 00	2.25920E-02	3.93474E 00
405	1.52275E 00	-2.05130E-02	3.93474E 00
406	1.53062E 00	-2.05130E-02	3.93474E 00
407	1.53849E 00	1.86665E-02	3.93474E 00
408	1.54636E 00	1.86665E-02	3.93474E 00
409	1.55422E 00	-1.70574E-02	3.93474E 00
410	1.56209E 00	-1.70574E-02	3.93474E 00
411	1.56996E 00	1.56858E-02	3.93474E 00
412	1.57783E 00	1.56858E-02	3.93474E 00
413	1.58570E 00	-1.45555E-02	3.93474E 00
414	1.59357E 00	-1.45555E-02	3.93474E 00
415	1.60144E 00	1.36639E-02	3.93474E 00
416	1.60931E 00	1.36639E-02	3.93474E 00
417	1.61718E 00	-1.30124E-02	3.93474E 00
418	1.62505E 00	-1.30124E-02	3.93474E 00
419	1.63292E 00	1.25984E-02	3.93474E 00
420	1.64079E 00	1.25984E-02	3.93474E 00
421	1.64866E 00	-1.24193E-02	3.93474E 00
422	1.65653E 00	-1.24193E-02	3.93474E 00

TRANSDUCER NAME: ECOMMT BPQ APODIZED VASILE TRANSDUCER
DATE: JAN 20,1978
REF DES: M12
TOTAL NUMBER OF ELECTRODE STRIPES: 422

SIZE	FSCM NO.	DRAWING NO.	REV
A	05869	1950514	21
SCALE: NONE		SHEET	

92508-2

REVISIONS					
AUTHORITY	ZONE	LTR	DESCRIPTION	DATE	APPROVED
DDT 74356		-	PRODUCTION RELEASE	77-11-1[illegible]	[illegible]



NOTES - UNLESS OTHERWISE SPECIFIED

1. FOR SCHEMATIC DIAGRAM SEE 1950516.
2. THIS ITEM SHALL MEET THE REQUIREMENTS OF 1950512-600.
3. IDENTIFICATION MARKING PER P80-3.
4. SEAL ASSEMBLY USING ITEM 3 OR BY PROJECTION WELDING (MFG OPTION).

SEE SEPARATE PARTS LIST

NEXT ASSY: -	USED ON: SAW MMT	EXCEPT AS NOTED DIM. ARE IN INCHES AND PER ANS Y14.5 XXX ±.010 XX ±.03 ANGLES ±0°30'	CONTRACT: DAAB07-75-C-0044	HUGHES	HUGHES AIRCRAFT COMPANY FULLERTON, CALIFORNIA
APPLICATION		MATERIAL	DR L. Y. Arakaki 77-10-28	DELAY LINE, SURFACE ACOUSTIC WAVE - CENTER FREQ 150 MHz, BANDWIDTH 30 MHz (BANDPASS FILTER)	
			CHK R. Burns 77-10-29	SIZE B CODE IDENT NO 05869	DRAWING NO. 1950515-100
			APPD [illegible] 77-[illegible]	SCALE NONE	SHEET

11-063B-1 GS 7/73 12-66-42 FORM 3

PARTS LIST TRANSMITTAL

HUGHES AIRCRAFT COMPANY
FULLERTON, CALIFORNIA

ISSUE: | ACTION: A | 10 CONTRACT: DAAB07-75-C-0044 | PL 1950515-100 | CODE IDENT: 05869 | 11 REV: - | YR MO DAY: 77 09 23

12 LIST TITLE: DELAY LINE, SAW | 13 MAINT: | 14 PROJECT: SAW MMT | 15 REFERENCE NO.: | 16 REV AUTH: | SHEET 1 OF 1

	ITEM NO.	LINE NO	QUANTITY REQUIRED (20)	UNIT OF MEAS (21)	CODE IDENT (22)	PART OR IDENT NUMBER (23)	DESCRIPTION (24)	SPECIFICATION OR REFERENCE (25)	REF DESIGNATION FROM (26)	THRU (27)	AUTH (28)	AT LR (29)	P. NOTE
A	1		1			1950516	SUBASSY						
A	2		1		29172	20216	COVER	TEKFORM					
A	3		AR			4277250-996	SOLDER, SN76IW5	QQ-S-571					
A	1900		REF			1950516	SCHEMATIC DIAG						
A	1901		REF			1950512-600	DESGN PERF SPEC						
A	1902		REF			P80-3	IDENT MARKING						

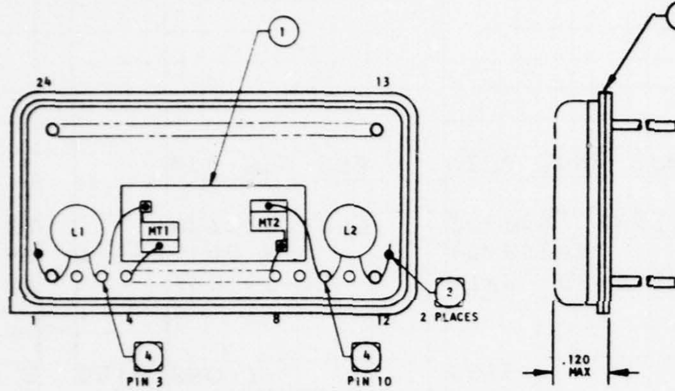
PREPARED BY	DATE	CHECKED BY	DATE	APPROVED BY	DATE	APPROVED BY	DATE
H. Burns	77-09-23		77-	[illegible]	77-11-09		77-

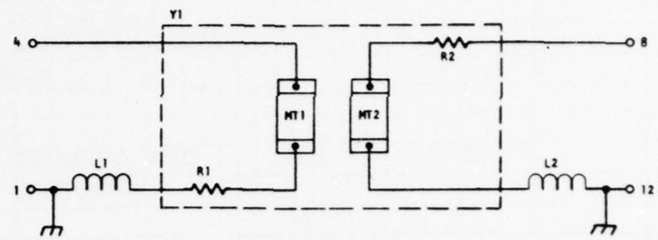
92508-9

AUTHORITY	LTR	DESCRIPTION	DATE	APPROVED
DDT 74356	-	PRODUCTION RELEASE	77-11-11	

REVISIONS

DWG NO 1950516





SCHEMATIC DIAGRAM

NOTES - UNLESS OTHERWISE SPECIFIED:

1. ATTACH ITEM 1 TO ITEM 2 USING ITEM 7.
2. SOLDER LEADS OF L1 AND L2 TO HEADER AND HEADER PINS AS SHOWN USING ITEM 8.
3. ALL OTHER CONNECTIONS ARE WIRE BONDS PER MIL-STD-883, METHOD 2017 USING ITEM 6.
4. CLIP INDICATED PIN FLUSH WITH FAR SIDE OF HEADER.
5. (NOT USED)
6. TUNE L1 AND L2 TO MEET THE PERFORMANCE REQUIREMENTS OF 19500512-600 BY ADJUSTING SPACING BETWEEN TURNS, THEN BOND TO ITEM 2 USING ITEM 7.

SEE SEPARATE PARTS LIST

1950515-100	SAW MMT
NEXT ASSY	USED ON
APPLICATION	

EXCEPT AS NOTED DIM ARE IN INCHES AND PER ANSI Y14.5 .XXX .XX ANGLES ±.010 ±.03 ±0.5°

MATERIAL

CONTRACT: DAAB07-75-C-0044

DR 77-11-08

CHK 77-11-08

APPD 77-11-09

HUGHES

HUGHES AIRCRAFT COMPANY FULLERTON, CALIFORNIA

DELAY LINE SUBASSEMBLY, SURFACE ACOUSTIC WAVE - CENTER FREQ 150 MHz, BANDWIDTH 30 MHz

SIZE	FSCM NO	DWG NO	REV
C	05869	1950516	
SCALE NONE		SHEET	

12-67-31 FORM 3

FORM NO. 110648-CS-GS REV. 7-76
DIETERICH-POST CLEARPRINT 1000H-10

PARTS LIST TRANSMITTAL

HUGHES AIRCRAFT COMPANY
FULLERTON, CALIFORNIA

ISSUE	ACTION	10 CONTRACT	PL	CODE IDENT	YR	MO	DAY
	A	DAAB07-75-C-0044	1950516	05869	77	09	26

12 LIST TITLE	13 MAINT	14 PROJECT	15 REFERENCE NO.	16 REV AUTH	SHEET
DELAY LINE SUBASSY, SAW		MMT			1 OF 1

Action	ITEM NO.	LINE NO.	QUANTITY REQUIRED (20)	UNIT OF MEAS (21)	CODE IDENT (22)	PART OR IDENT NUMBER (23)	DESCRIPTION (24)	SPECIFICATION OR REFERENCE (25)	REF DESIGNATION FROM (26)	THRU (27)	AUTH (28)	WT LB (29)	PL NOTE
A	1		1			1950517	CRYSTAL		Y1				
A	2		1		29172	20221	HEADER	TEKFORM					
A	3		2		55167	850-7	COIL	CORONA MAG	L1	2			
N	4												
N	5												
A	6		AR			760660-11	WIRE, GOLD .001						
A	7		AR		71984	3140 RTV	ADHESIVE	DOW CORNING					
A	8		AR			4277250-999	SOLDER, SN63	QQ-S-571					
A	4900		REF			MIL-STD-883	WIRE BOND SPEC						

PREPARED BY	DATE	CHECKED BY	DATE	APPROVED	DATE	APPROVED BY	DATE
Jo. Burns	77-09-26		77- -		77-11-09		77- -

REVISIONS				
AUTHORITY	LTR	DESCRIPTION	DATE	APPROVED
DDT [illegible]	-	PRODUCTION RELEASE	7[illegible]	[illegible]

NOTES:

1. MATERIAL: LITHIUM NIOBATE
   PER
2. FABRICATE PER 780294
3. DEPOSITION THICKNESS:
   0.20 ±0.01 μm
   (2000)±100 Å)

4. INDICATES DIRECTION OF SPECIFIED CRYSTALLINE AXIS & PROPAGATION DIRECTION.

5. HORIZONTAL CENTERLINES OF MT1 & MT2 SHALL BE CO-LINEAR WITHIN AND PARALLEL TO -AXIS WITHIN 0.25°.

6. IN DIMENSIONAL LISTINGS, THE NO. FOLLOWING THE LETTER E INDICATES THE POWER OF 10 BY WHICH THE NO. MUST BE MULTIPLIED TO OBTAIN THE CORRECT VALUE. FOR EXAMPLE:

   $1.45870E-02 = 1.45870 \times 10^{-2} = 0.014587$

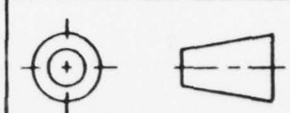
   $1.34567E\ 00 = 1.34567 \times 10^{0} = 1.34567$

7. DEPOSITION FILM APPLIED IN INDICATED AREA.
8. INDICATED SURFACE TO BE CORRUGATED PER P82

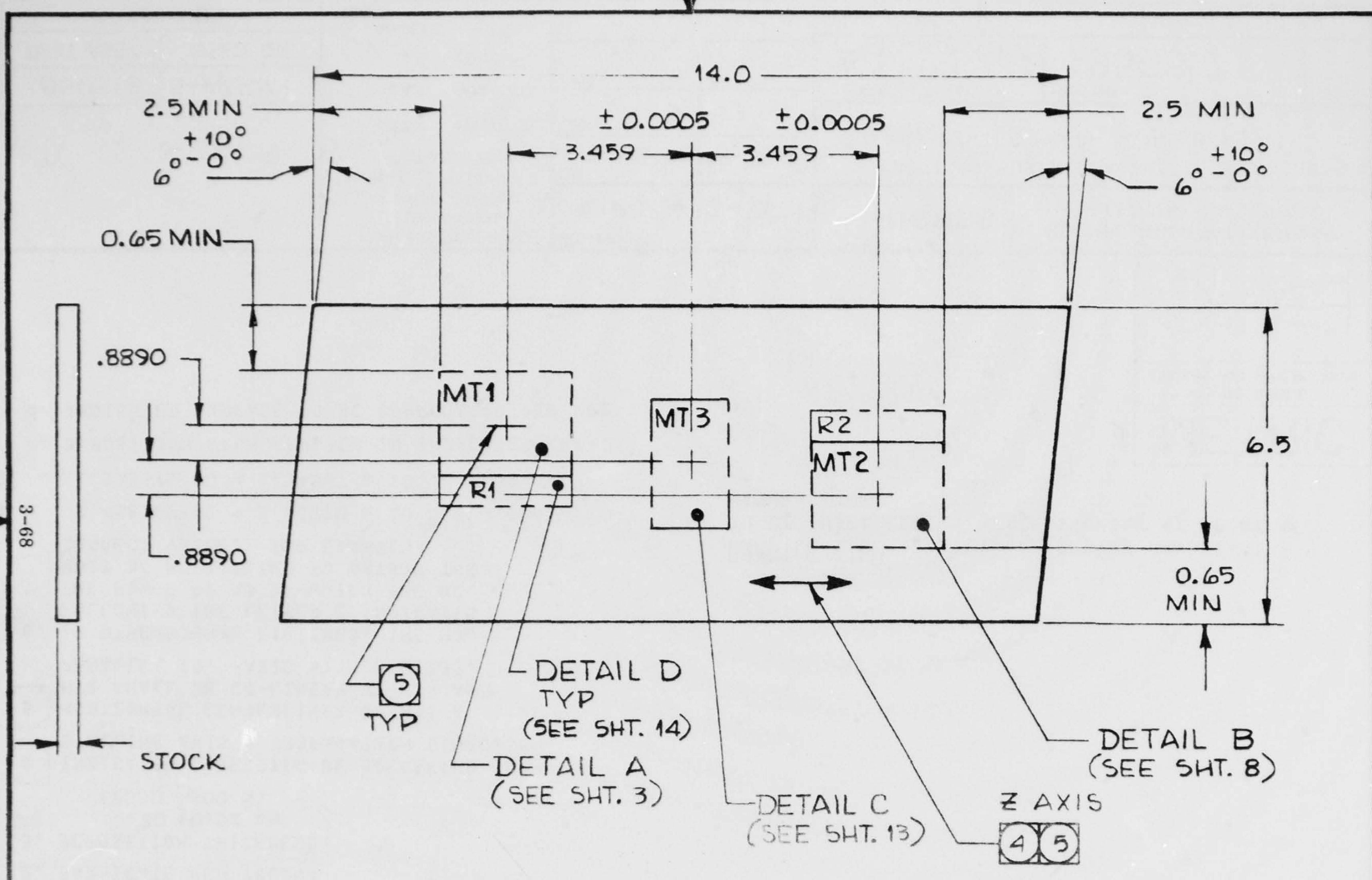
FRAGILE ITEM (EASILY DAMAGED BY HANDLING) - TO BE INSTALLED IN NEXT ASSEMBLY AT POINT OF MANUFACTURE.

METRIC

THIRD ANGLE (AMERICAN) PROJECTION

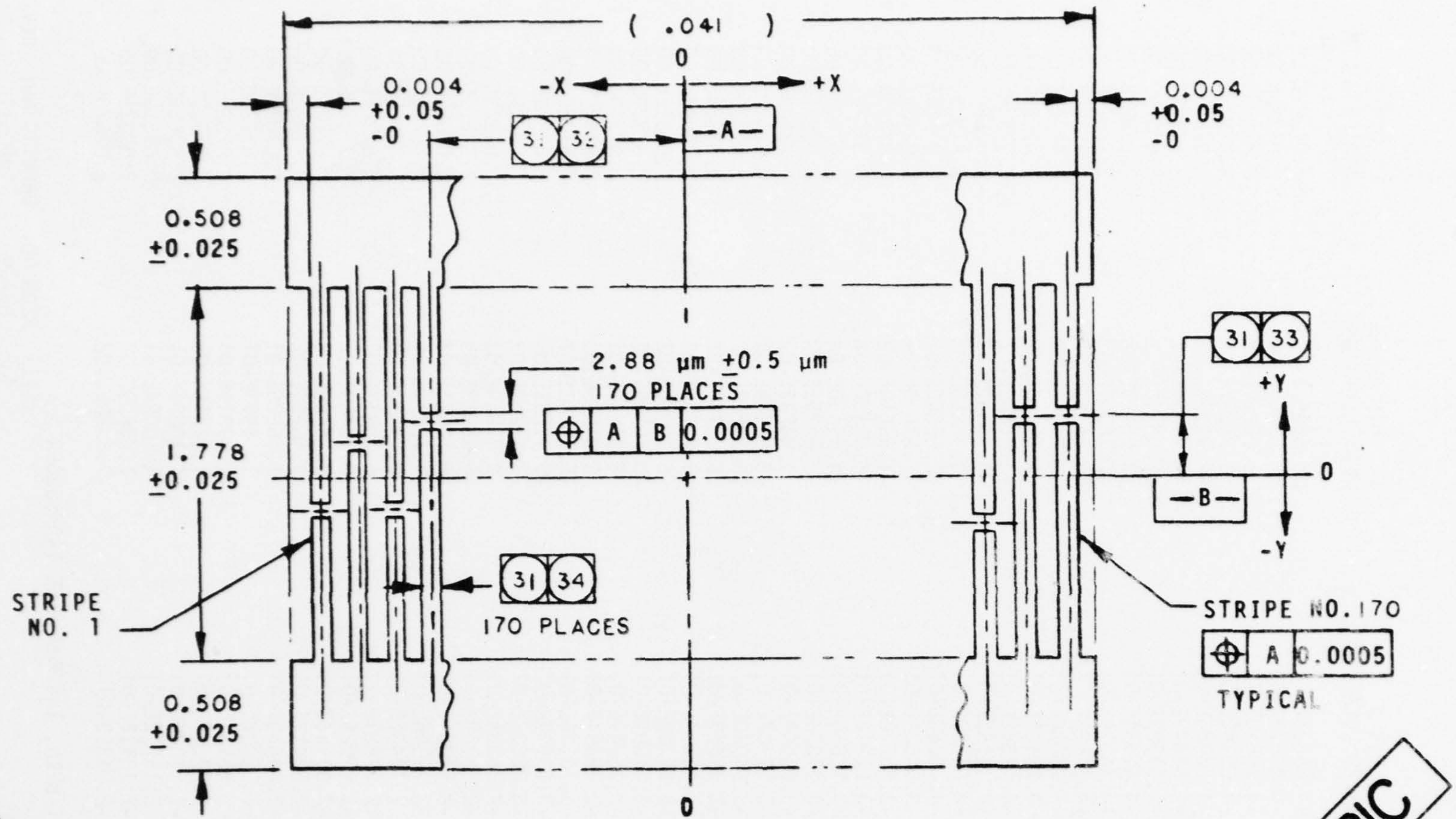


1950516	SAW/MMT	UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN MILLIMETERS & PER ANSI Y14.5	CONTRACT: DAAB07-75C-0074		HUGHES	HUGHES AIRCRAFT COMPANY FULLERTON, CALIFORNIA			
NEXT ASSY	USED ON	.XXX ±0.002	DR K.S.KELLY	78-05-16	CRYSTAL, SURFACE ACOUSTIC WAVE - BP-LN 150 MHz CENTER FREQ., 50 MHz BANDWITH				
APPLICATION		.XX ±0.02	CHK		SIZE A	FSCM NO. 05869	DWG NO. 1950517		REV
		.X ±0.5	APPD [signature]	7[illegible]	SCALE NONE	WT	SHEET 1 OF 14		
		ANGLES ±2°							



SIZE	CODE IDENT NO.	DRAWING NO.		REV
A	05869	1950517		
SCALE NONE			SHEET 2	

1 -061-1 CS-I-S 10/73



DETAIL A

NOTES:

31. FOR DIM S, X, & Y, SEE SHEETS 4-7.
32. DIM X ARE BASIC DIM TO CENTERLINES OF STRIPES.
33. DIM Y ARE BASIC DIM TO CENTERLINES OF STRIPE BREAKS.
34. TOLERANCE: ±0.1 µm PER µm.

HUGHES AIRCRAFT COMPANY FULLERTON, CALIFORNIA	CONTRACT: DAAB07-75C-0074			
DR K.S. KELLY	SIZE A	FSCM NO. 05869	DWG NO. 1950517	REV
ISSUED	SCALE NONE		SHEET 3	

STRIPE NO.	DIM X STRIPE LOCATION	DIM Y BREAK LOCATION	DIM S STRIPE WIDTH
1	-4.86432E-01	5.66407E-02	2.87829E 00
2	-4.80675E-01	5.66407E-02	2.87829E 00
3	-4.74818E-01	1.90297E-02	2.87829E 00
4	-4.69162E-01	1.90297E-02	2.87829E 00
5	-4.63405E-01	-2.21336E-02	2.87829E 00
6	-4.57649E-01	-2.21336E-02	2.87829E 00
7	-4.51892E-01	2.68795E-02	2.87829E 00
8	-4.46135E-01	2.68795E-02	2.87829E 00
9	-4.46379E-01	-3.16357E-02	2.87829E 00
10	-4.34622E-01	-3.16357E-02	2.87829E 00
11	-4.28886E-01	3.41986E-02	2.87829E 00
12	-4.23109E-01	3.41986E-02	2.87829E 00
13	-4.17352E-01	-3.28562E-02	2.87829E 00
14	-4.11596E-01	-3.28562E-02	2.87829E 00
15	-4.05839E-01	2.68865E-02	2.87829E 00
16	-4.00083E-01	2.66865E-02	2.87829E 00
17	-3.94326E-01	-1.54610E-02	2.87829E 00
18	-3.88570E-01	-1.54610E-02	2.87829E 00
19	-3.82813E-01	-1.51130E-04	2.87829E 00
20	-3.77056E-01	-1.51130E-04	2.87829E 00
21	-3.71300E-01	1.84252E-02	2.87829E 00
22	-3.65543E-01	1.84252E-02	2.87829E 00
23	-3.59787E-01	-3.68249E-02	2.87829E 00
24	-3.54030E-01	-3.68249E-02	2.87829E 00
25	-3.48273E-01	5.23786E-02	2.87829E 00
26	-3.42517E-01	5.23786E-02	2.87829E 00
27	-3.36760E-01	-6.20306E-02	2.87829E 00
28	-3.31004E-01	-6.20306E-02	2.87829E 00
29	-3.25247E-01	6.31545E-02	2.87829E 00
30	-3.19491E-01	6.31545E-02	2.87829E 00
31	-3.13734E-01	-5.41261E-02	2.87829E 00
32	-3.07977E-01	-5.41261E-02	2.87829E 00
33	-3.02221E-01	3.47269E-02	2.87829E 00
34	-2.96484E-01	3.47269E-02	2.87829E 00
35	-2.90708E-01	-6.36523E-03	2.87829E 00
36	-2.84951E-01	-6.36523E-03	2.87829E 00
37	-2.79194E-01	-2.78498E-02	2.78729E 00
38	-2.73438E-01	-2.78498E-02	2.87829E 00
39	-2.67681E-01	6.33463E-02	2.87829E 00
40	-2.61925E-01	6.33463E-02	2.87829E 00
41	-2.56168E-01	-9.46250E-02	2.87829E 00
42	-2.50412E-01	-9.46250E-02	2.87829E 00
43	-2.44655E-01	1.15975E-01	2.87829E 00
44	-2.38898E-01	1.15975E-01	2.87829E 00
45	-2.33142E-01	-1.22315E-01	2.87829E 00
46	-2.27385E-01	-1.22315E-01	2.87829E 00
47	-2.21629E-01	1.10094E-01	2.87829E 00
48	-2.15872E-01	1.10094E-01	2.87829E 00
49	-2.10115E-01	-7.80809E-02	2.87829E 00
50	-2.04359-01	-7.80809E-02	2.87829E 00

TRANSDUCER NAME: ECOMMT BPLN, 148 MHZ RICE TRANSDUCER
DATE: JAN 20, 1978
REF DES: MT1
TOTAL NUMBER OF ELECTRODE STRIPES: 170

SIZE	FSCM NO.	DRAWING NO.	REV
A	05869	1950517	
SCALE:	NONE	SHEET	4

STRIPE NO.	DIM X STRIPE LOCATION	DIM Y BREAK LOCATION	DIM S STRIPE WIDTH
51	-1.98802E-01	2.78778E-02	2.87829E 00
52	-1.92846E-01	2.78778E-02	2.87829E 00
53	-1.87889E-01	3.58737E-02	2.87829E 00
54	-1.81332E-01	3.58737E-02	2.87829E 00
55	-1.75576E-01	-1.05683E-01	2.87829E 00
56	-1.69819E-01	-1.05683E-01	2.87829E 00
57	-1.64063E-01	1.71845E-01	2.87829E 00
58	-1.58306E-01	1.71845E-01	2.87829E 00
59	-1.52550E-01	-2.23444E-01	2.87829E 00
60	-1.46793E-01	-2.23444E-01	2.87829E 00
61	-1.41036E-01	2.49599E-01	2.87829E 00
62	-1.35280E-01	2.49599E-01	2.87829E 00
63	-1.29523E-01	-2.40862E-01	2.87829E 00
64	-1.23767E-01	-2.40862E-01	2.87829E 00
65	-1.18010E-01	1.90549E-01	2.87829E 00
66	-1.12253E-01	1.90549E-01	2.87829E 00
67	-1.06497E-01	-9.58506E-02	2.87829E 00
68	-1.06740E-01	-9.58505E-02	2.87829E 00
69	-9.49836E-02	-4.14820E-02	2.87829E 00
70	-8.92271E-02	-4.14820E-02	2.87829E 00
71	-8.34705E-02	2.14911E-01	2.87829E 00
72	-7.77139E-02	2.14911E-01	2.87829E 00
73	-7.19873E-02	-4.13476E-01	2.87829E 00
74	-6.62007E-02	-4.13476E-01	2.87829E 00
75	-6.04442E-02	6.22729E-01	2.87829E 00
76	-5.46876E-02	6.22729E-01	2.87829E 00
77	-4.89310E-02	-8.26083E-01	2.87829E 00
78	-4.31744E-02	-8.26083E-01	2.87829E 00
79	-3.74178E-02	1.00650E 00	2.87829E 00
80	-3.16612E-02	1.00650E 00	2.87829E 00
81	-2.59046E-02	-1.14830E 00	2.87829E 00
82	-2.01481E-02	-1.14830E 00	2.87829E 00
83	-1.43916E-02	1.23887E 00	2.87829E 00
84	-8.63488E-03	1.23887E 00	2.87829E 00
85	-2.87829E-03	-1.27000E 00	2.87829E 00
86	2.87829E-03	-1.27000E 00	2.87829E 00
87	8.63488E-03	1.23887E 00	2.87829E 00
88	1.43915E-02	1.23887E 00	2.87829E 00
89	2.01481E-02	-1.14830E 00	2.87829E 00
90	2.59046E-02	-1.14830E 00	2.87829E 00
91	3.16612E-02	1.00650E 00	2.87829E 00
92	3.74178E-02	1.00650E 00	2.87829E 00
93	4.31744E-02	-8.26083E-01	2.87829E 00
94	4.89310E-02	-8.26083E-01	2.87829E 00
95	5.46876E-02	6.22729E-01	2.87829E 00
96	6.04442E-02	6.22729E-01	2.87829E 00
97	6.62007E-02	-4.13476E-01	2.87829E 00
98	7.19573E-02	-4.13476E-01	2.87829E 00
99	7.77139E-02	2.14911E-01	2.87829E 00
100	8.34705E-02	2.14911E-01	2.87829E 00

TRANSDUCER NAME: ECOMMT BPLN, 148MHZ RICE TRANSDUCER
DATE: JAN 20, 1978
REF DES: MT1
TOTAL NUMBER OF ELECTRODE STRIPES: 170

SIZE	FSCM NO.	DRAWING NO.	REV
A	05869	1950517	
SCALE:	NONE	SHEET	5

STRIPE NO.	DIM X STRIPE LOCATION	DIM Y BREAK LOCATION	DIM S STRIPE WIDTH
101	8.92271E-02	-4.14820E-02	2.87829E 00
102	9.49836E-02	-4.14820E-02	2.87829E 00
103	1.00740E-01	-9.58505E-02	2.87829E 00
104	1.06497E-01	-9.58505E-02	2.87829E 00
105	1.12253E-01	1.90549E-01	2.87829E 00
106	1.18010E-01	1.90549E-01	2.87829E 00
107	1.23767E-01	-2.40862E-01	2.87829E 00
108	1.29523E-01	-2.40862E-01	2.87829E 00
109	1.35280E-01	2.49599E-01	2.87829E 00
110	1.41036E-01	2.49599E-01	2.87829E 00
111	1.46793E-01	-2.23444E-01	2.87829E 00
112	1.52550E-01	-2.23444E-01	2.87829E 00
113	1.68306E-01	1.71845E-01	2.87829E 00
114	1.64063E-01	1.71845E-01	2.87829E 00
115	1.69819E-01	-1.05683E-01	2.87829E 00
116	1.75576E-01	-1.05683E-01	2.87829E 00
117	1.81332E-01	3.58737E-02	2.87829E 00
118	1.87089E-01	3.58737E-02	2.87829E 00
119	1.92846E-01	2.78778E-02	2.87829E 00
120	1.98602E-01	2.78778E-02	2.87829E 00
121	2.04359E-01	-7.80809E-02	2.87829E 00
122	2.10115E-01	-7.80809E-02	2.87829E 00
123	2.15872E-01	1.10094E-01	2.87829E 00
124	2.21029E-01	1.10094E-01	2.87829E 00
125	2.27385E-01	-1.22315E-01	2.87829E 00
126	2.33142E-01	-1.22315E-01	2.87829E 00
127	2.38898E-01	1.15975E-01	2.87829E 00
128	2.44655E-01	1.15975E-01	2.87829E 00
129	2.50412E-01	-9.46250E-02	2.87829E 00
130	2.56168E-01	-9.46250E-02	2.87829E 00
131	3.61925E-01	6.33463E-02	2.87829E 00
132	2.67681E-01	6.33463E-02	2.87829E 00
133	2.73438E-01	-2.78498E-02	2.87829E 00
134	2.79194E-01	-2.78498E-02	2.87829E 00
135	2.84951E-01	-6.36523E-03	2.87829E 00
136	2.90708E-01	-6.36523-03	2.87829E 00
137	2.96464E-01	3.47269E-02	2.87829E 00
138	3.02221E-01	3.47269E-02	2.87829E 00
139	3.07977E-01	-6.41261E-02	2.87829E 00
140	3.13734E-01	-5.41261E-02	2.87829E 00
141	3.19491E-01	6.31545E-02	2.87829E 00
142	3.25247E-01	6.31545E-02	2.87829E 00
143	3.31004E-01	-6.20306E-02	2.87829E 00
144	3.36760E-01	-6.20306E-02	2.87829E 00
145	3.42517E-01	5.23786E-02	2.87829E 00
146	3.48273E-01	5.23786E-02	2.87829E 00
147	3.54030E-01	-3.68249E-02	2.87829E 00
148	3.59787E-01	-3.68249E-02	2.87829E 00
149	3.65543E-01	1.84252E-02	2.87829E 00
150	3.71300E-01	1.84252E-02	2.87829E 00

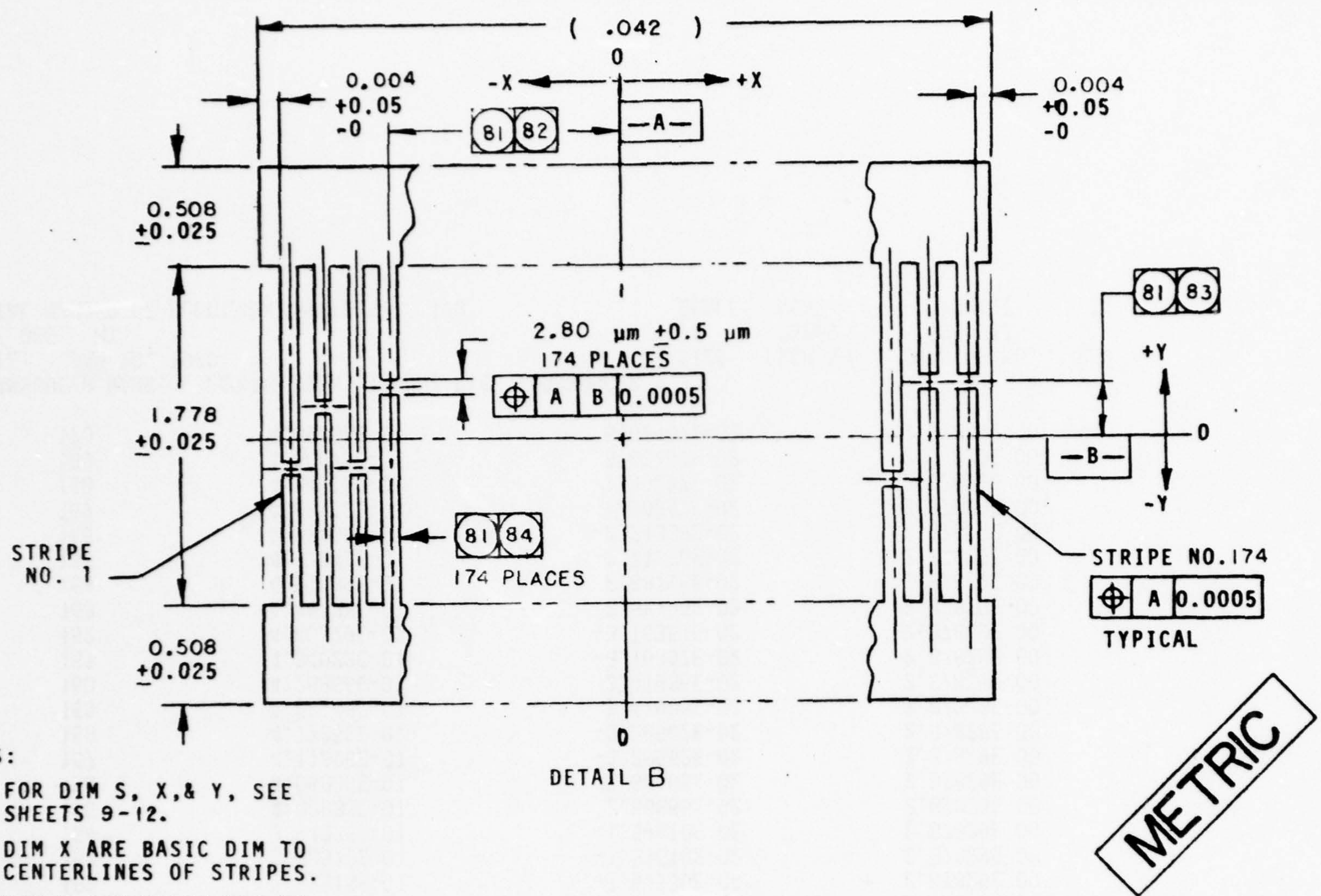
TRANSDUCER NAME: ECOMMT BPLN, 148MHZ RICE TRANSDUCER
DATE: JAN 20, 1978
REF DES: MT1
TOTAL NUMBER OF ELECTRODE STRIPES: 170

SIZE	FSCM NO.	DRAWING NO.	REV
A	05869	1950517	
SCALE:	NONE	SHEET	6

STRIPE NO.	DIM X STRIPE LOCATION	DIM Y BREAK LOCATION	DIM S STRIPE WIDTH
151	3.77056E-01	-1.51130E-04	2.87829E 00
152	3.82813E-01	-1.51130E-04	2.87829E 00
153	3.88570E-01	-1.54610E-02	2.87829E 00
154	3.94326E-01	-1.54610E-02	2.87829E 00
155	4.00083E-01	2.66865E-02	2.87829E 00
156	4.05839E-01	2.66865E-02	2.87829E 00
157	4.11596E-01	-3.28562E-02	2.87829E 00
158	4.17352E-01	-3.28562E-02	2.87829E 00
159	4.23109E-01	3.41986E-02	2.87829E 00
160	4.28866E-01	3.41986E-02	2.87829E 00
161	4.34022E-01	-3.16357E-02	2.87829E 00
162	4.40379E-01	-3.16357E-02	2.87829E 00
163	4.46135E-01	2.68795E-02	2.87829E 00
164	4.51892E-01	2.68795E-02	2.87829E 00
165	4.57649E-01	-2.21336E-02	2.87829E 00
166	4.83405E-01	-2.21336E-02	2.87829E 00
167	4.69162E-01	1.90297E-02	2.87829E 00
168	4.74918E-01	1.90297E-02	2.87829E 00
169	4.80675E-01	5.66407E-02	2.87829E 00
170	4.86432E-01	5.66407E-02	2.87829E 00

TRANSDUCER NAME: ECOMMT BPLN, 148MHZ RICE TRANSDUCER
DATE: JAN 20, 1978
REF DES: MT1
TOTAL NUMBER OF ELECTRODE STRIPES: 170

SIZE	FSCM NO.	DRAWING NO.	REV
A	05869	1950517	
SCALE:	NONE	SHEET	7



DETAIL B

NOTES:

81 FOR DIM S, X, & Y, SEE SHEETS 9-12.

82 DIM X ARE BASIC DIM TO CENTERLINES OF STRIPES.

83 DIM Y ARE BASIC DIM TO CENTERLINES OF STRIPE BREAKS.

84 TOLERANCE: ±0.1 µm PER µm.

HUGHES AIRCRAFT COMPANY FULLERTON, CALIFORNIA	CONTRACT: DAAB07-75C-0074			
DR K. S. KELLY	SIZE A	FSCM NO. 05869	DWG NO. 1950517	REV
ISSUED	SCALE NONE		SHEET 8	

STRIPE NO.	DIM X STRIPE LOCATION	DIM Y BREAK LOCATION	DIM S STRIPE WIDTH
1	-4.84841E-01	5.72935E-02	2.80255E 00
2	-4.79236E-01	5.72935E-02	2.80255E 00
3	-4.73631E-01	3.15138E-02	2.80255E 00
4	-4.68026E-01	3.15138E-02	2.80255E 00
5	-4.62421E-01	-3.08419E-02	2.80255E 00
6	-4.56815E-01	-3.08419E-02	2.80255E 00
7	-4.51210E-01	3.25221E-02	2.80255E 00
8	-4.45635E-01	3.25221E-02	2.80255E 00
9	-4.40000E-01	-3.41985E-02	2.80255E 00
10	-4.34395E-01	-3.41985E-02	2.80255E 00
11	-4.28790E-01	3.35356E-02	2.80255E 00
12	-4.23185E-01	3.35356E-02	2.80255E 00
13	-4.17580E-01	-2.94843E-02	2.80255E 00
14	-4.11975E-01	-2.94843E-02	2.80255E 00
15	-4.06370E-01	2.10172E-02	2.80255E 00
16	-4.00764E-01	2.10172E-02	2.80255E 00
17	-3.95159E-01	-8.17625E-03	2.80255E 00
18	-3.89554E-01	-8.17625E-03	2.80255E 00
19	-3.83949E-01	-7.89812E-03	2.80255E 00
20	-3.78344E-01	-7.89812E-03	2.80255E 00
21	-3.72739E-01	2.55206E-02	2.80255E 00
22	-3.67134E-01	2.55206E-02	2.80255E 00
23	-3.61529E-01	-4.22757E-02	2.80255E 00
24	-3.55924E-01	-4.22757E-02	2.80255E 00
25	-3.50319E-01	5.55041E-02	2.80255E 00
26	-3.44714E-01	5.55041E-02	2.80255E 00
27	-3.39108E-01	-6.26706E-02	2.80255E 00
28	-3.33503E-01	-6.26706E-02	2.80255E 00
29	-3.27898E-01	6.16051E-02	2.80255E 00
30	-3.22293E-01	6.16051E-02	2.80255E 00
31	-3.16688E-01	-5.11213E-02	2.80255E 00
32	-3.11083E-01	-5.11213E-02	2.80255E 00
33	-3.05478E-01	3.12725E-02	2.80255E 00
34	-2.99873E-01	3.12725E-02	2.80255E 00
35	-2.94268E-01	-3.49758E-03	2.80255E 00
36	-2.88662E-01	-3.49758E-03	2.90255E 00
37	-2.83057E-01	-2.93040E-02	2.80255E 00
38	-2.77452E-01	-2.93040E-02	2.80255E 00
39	-2.71847E-01	6.30999E-02	2.80255E 00
40	-2.66242E-01	6.30999E-02	2.80255E 00
41	-2.60637E-01	-9.30731E-02	2.80255E 00
42	-2.55032E-01	-9.30731E-02	2.80255E 00
43	-2.49427E-01	1.14181E-01	2.80255E 00
44	-2.43822E-01	1.14181E-01	2.80255E 00
45	-2.38217E-01	-1.21912E-01	2.80255E 00
46	-2.32612E-01	-1.21912E-01	2.80255E 00
47	-2.27006E-01	1.12959E-01	2.80255E 00
48	-2.21401E-01	1.12959E-01	2.80255E 00
49	-2.15798E-01	-8.58824E-02	2.80255E 00
50	-2.10191E-01	-8.58824E-02	2.80255E 00

TRANSDUCER NAME: ECOMMT BPLN, 152MHZ RICE TRANSDUCER
DATE: JAN 20, 1978
REF DES: MT2
TOTAL NUMBER OF ELECTRODE STRIPES: 174

SIZE	FSCM NO.	DRAWING NO.	REV
A	05869	1950517	
SCALE:	NONE	SHEET	9

STRIPE NO.	DIM X STRIPE LOCATION	DIM Y BREAK LOCATION	DIM S STRIPE WIDTH
51	-2.04586E-01	4.16039E-02	2.80255E 00
52	-1.98981E-01	4.16039E-02	2.80255E 00
53	-1.93378E-01	1.64351E-02	2.80255E 00
54	-1.87771E-01	1.64351E-02	2.80255E 00
55	-1.82166E-01	-8.23009E-02	2.80255E 00
56	-1.76561E-01	-8.23009E-02	2.80255E 00
57	-1.70955E-01	1.47993E-01	2.80255E 00
58	-1.65351E-01	1.47993E-01	2.80255E 00
59	-1.59745E-01	-2.04175E-01	2.80255E 00
60	-1.54140E-01	-2.04175E-01	2.80255E 00
61	-1.48535E-01	2.41097E-01	2.80255E 00
62	-1.42930E-01	2.41097E-01	2.80255E 00
63	-1.37325E-01	-2.49735E-01	2.80255E 00
64	-1.31720E-01	-2.49735E-01	2.80255E 00
65	-1.26115E-01	2.22894E-01	2.80255E 00
66	-1.22514E-01	2.22894E-01	2.80255E 00
67	-1.14904E-01	-1.56195E-01	2.80255E 00
68	-1.09299E-01	-1.56195E-01	2.80255E 00
69	-1.03694E-01	4.88569E-02	2.80255E 00
70	-9.80892E-02	4.88569E-02	2.80255E 00
71	-9.24821E-02	9.59179E-02	2.80255E 00
72	-8.68790E-02	9.59179E-02	2.80255E 00
73	-8.12739E-02	-2.70940E-01	2.80255E 00
74	-7.56688E-02	-2.70940E-01	2.80255E 00
75	-7.00637E-02	4.65489E-01	2.80255E 00
76	-8.44586E-02	4.65489E-01	2.80255E 00
77	-5.88535E-02	-6.66195E-01	2.80255E 00
78	-5.32484E-02	-6.66195E-01	2.80255E 00
79	-4.76433E-02	8.58214E-01	2.80255E 00
80	-4.20382E-02	8.58214E-01	2.80255E 00
81	-3.64331E-02	-1.02664E 00	2.80255E 00
82	-3.08280E-02	-1.02664E 00	2.80255E 00
83	-2.52229E-02	1.15796E 00	2.80255E 00
84	-1.96178E-02	1.15796E 00	2.80255E 00
85	-1.40127E-02	-1.24139E 00	2.80255E 00
86	-8.40764E-03	-1.24139E 00	2.80255E 00
87	-2.80255E-03	1.27000E 00	2.80255E 00
88	2.80255E-03	1.27000E 00	2.80255E 00
89	8.40764E-03	-1.24139E 00	2.80255E 00
90	1.40127E-02	-1.24139E 00	2.80255E 00
91	1.96178E-02	1.15796E 00	2.80255E 00
92	2.52229E-02	1.15796E 00	2.80255E 00
93	3.08280E-02	-1.02664E 00	2.80255E 00
94	3.64331E-02	-1.02664E 00	2.80255E 00
95	4.20382E-02	8.58214E-01	2.80255E 00
96	4.76433E-02	8.58214E-01	2.80255E 00
97	5.32484E-02	-6.66195E-01	2.80255E 00
98	5.88535E-02	-6.66195E-01	2.80255E 00
99	5.44586E-02	4.65489E-01	2.80255E 00
100	7.00637E-02	4.65489E-01	2.80255E 00

TRANSDUCER NAME: ECOMMT BPLN, 152MHZ RICE TRANSDUCER
DATE: JAN 20, 1978
REF DES: MT2
TOTAL NUMBER OF ELECTRODE STRIPES: 174

SIZE	FSCM NO.	DRAWING NO.	REV
A	05869	1950517	
SCALE:	NONE	SHEET	10

STRIPE NO.	DIM X STRIPE LOCATION	DIM Y BREAK LOCATION	DIM S STRIPE WIDTH
101	7.56688E-02	-2.78940E-01	2.80255E 00
102	8.12739E-02	-2.70940E-01	2.80255E 00
103	8.68790E-02	9.59179E-02	2.80255E 00
104	8.24841E-02	9.59179E-02	2.80255E 00
105	9.80892E-02	4.88569E-02	2.80255E 00
106	1.03694E 01	4.88569E-02	2.80255E 00
107	1.09299E-01	-1.56195E-01	2.80255E 00
108	1.14904E-01	-1.56195E-01	2.80255E 00
109	1.20510E-01	2.22894E-01	2.80255E 00
110	1.26115E-01	2.22894E-01	2.80255E 00
111	1.31720E-01	-2.49735E-01	2.80255E 00
112	1.37325E-01	-2.49735E-01	2.80255E 00
113	1.42930E-01	2.41097E-01	2.80255E 00
114	1.48535E-01	2.41097E-01	2.80255E 00
115	1.54140E-01	-2.04175E-01	2.80255E 00
116	1.59745E-01	-2.04175E-01	2.80255E 00
117	1.65350E-01	1.47993E-01	2.80255E 00
118	1.70955E-01	1.47993E-01	2.80255E 00
119	1.76561E-01	-8.23009E-02	2.80255E 00
120	1.82166E-01	-8.23009E-02	2.80255E 00
121	1.87771E-01	1.64351E-02	2.80255E 00
122	1.93376E-01	1.64351E-02	2.80255E 00
123	1.98981E-01	4.16039E-02	2.80255E 00
124	2.04586E-01	4.16039E-02	2.80255E 00
125	2.10191E-01	-8.58824E-02	2.80255E 00
126	2.15796E-01	-8.58824E-02	2.80255E 00
127	2.21401E-01	1.12959E-01	2.80255E 00
128	2.27006E-01	1.12959E-01	2.80255E 00
129	2.32812E-01	-1.21912E-01	2.80255E 00
130	2.38217E-01	-1.21912E-01	2.80255E 00
131	2.43822E-01	1.14181E-01	2.80255E 00
132	2.49427E-01	1.14181E-01	2.80255E 00
133	2.55032E-01	-8.30731E-02	2.80255E 00
134	2.60637E-01	-9.30731E-02	2.80255E 00
135	2.66242E-01	6.30999E-02	2.80255E 00
136	2.71847E-01	6.30999E-02	2.80255E 00
137	2.77452E-01	-2.93040E-02	2.80255E 00
138	2.83057E-01	-2.93040E-02	2.80255E 00
139	2.88662E-01	-3.49758E-03	2.80255E 00
140	2.94268E-01	-3.49758E-03	2.80255E 00
141	2.99873E-01	3.12725E-02	2.80255E 00
142	3.05478E-01	3.12725E-02	2.80255E 00
143	3.11083E-01	-5.11213E-02	2.80255E 00
144	3.16688E-01	-5.11213E-02	2.80255E 00
145	3.22293E-01	6.16051E-02	2.80255E 00
146	3.27898E-01	6.16051E-02	2.80255E 00
147	3.33503E-01	-6.26706E-02	2.80255E 00
148	3.39108E-01	-6.26706E-02	2.80255E 00
149	3.44714E-01	5.55041E-02	2.80255E 00
150	3.50319E-01	5.55041E-02	2.80255E 00

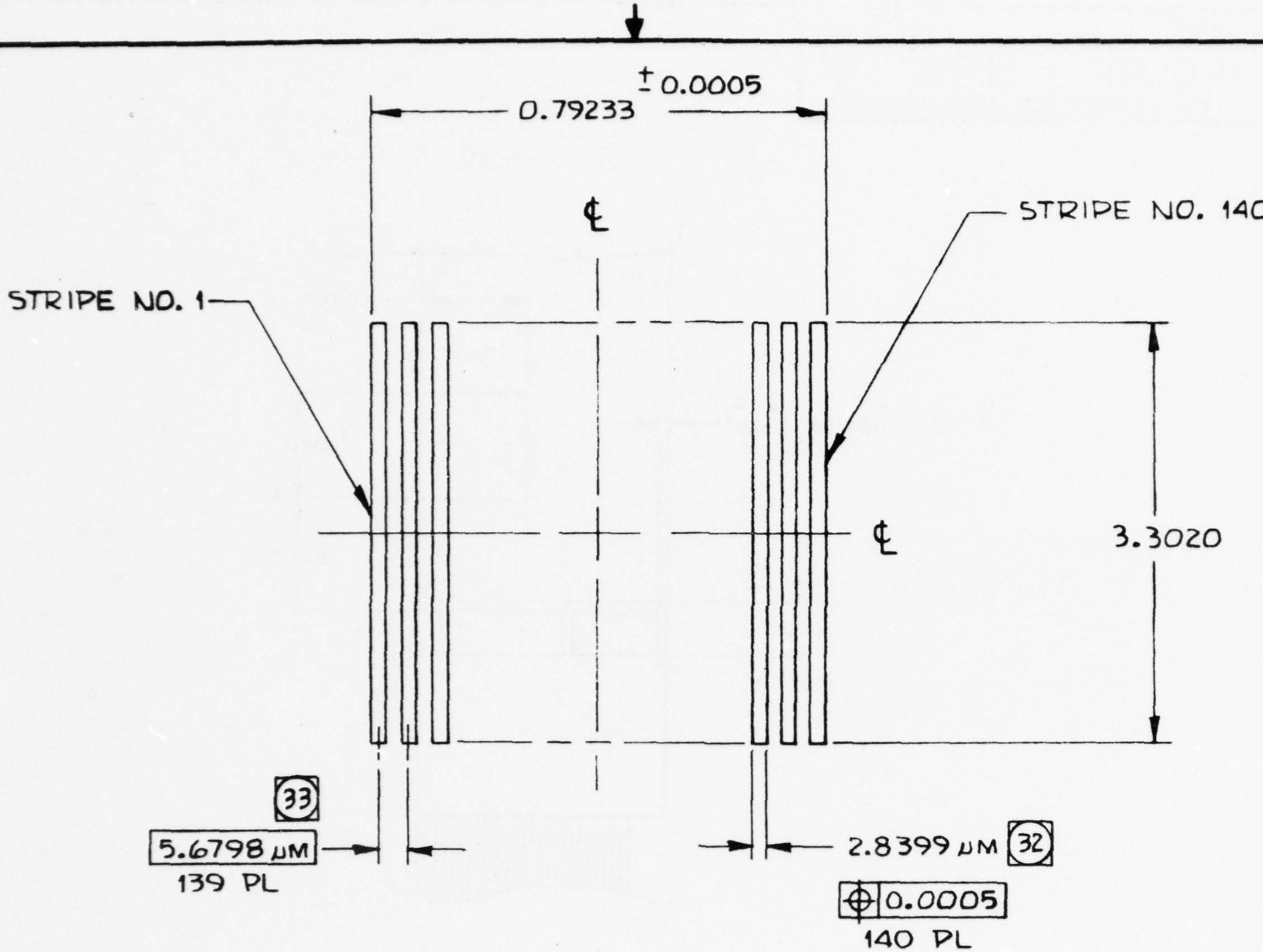
TRANSDUCER NAME: ECOMMT BPLN, 152MHZ RICE TRANSDUCER

DATE: JAN 20, 1978	SIZE	FSCM NO.	DRAWING NO.		REV
REF DES: MT2	A	05869	1950517		
TOTAL NUMBER OF ELECTRODE STRIPES: 174	SCALE:	NONE		SHEET	11

STRIPE NO.	DIM X STRIPE LOCATION	DIM Y BREAK LOCATION	DIM S STRIPE WIDTH
151	3.35924E-01	-4.22757E-02	2.80255E 00
152	3.61529E-01	-4.22757E-02	2.80255E 00
153	3.67134E-01	2.55206E-02	2.80255E 00
154	3.72739E-01	2.55206E-02	2.80255E 00
155	3.78344E-01	-7.89812E-03	2.80255E 00
156	3.83949E-01	-7.89812E-03	2.80255E 00
157	3.89554E-01	-8.17625E-03	2.80255E 00
158	3.95159E-01	-8.17625E-03	2.80255E 00
159	4.00764E-01	2.10172E-02	2.80255E 00
160	4.06370E-01	2.10172E-02	2.80255E 00
161	4.11975E-01	-2.94843E-02	2.80255E 00
162	4.17580E-01	-2.94843E-02	2.80255E 00
163	4.23185E-01	3.35356E-02	2.80255E 00
164	4.28790E-01	3.35356E-02	2.80255E 00
165	4.34395E-01	-3.41985E-02	2.80255E 00
166	4.40000E-01	-3.41985E-02	2.80255E 00
167	4.45605E-01	3.25221E-02	2.80255E 00
168	4.51210E-01	3.25221E-02	2.80255E 00
169	4.56715E-01	-3.08419E-02	2.80255E 00
170	4.62421E-01	-3.08419E-02	2.80255E 00
171	4.68026E-01	3.15138E-02	2.80255E 00
172	4.73631E-01	3.15138E-02	2.80255E 00
173	4.79236E-01	5.72935E-02	2.80255E 00
174	4.84841E-01	5.72935E-02	2.80255E 00

TRANSDUCER NAME: ECOMMT BPLN, 152MHZ RICE TRANSDUCER
DATE: JAN 20, 1978
REF DES: MT2
TOTAL NUMBER OF ELECTRODE STRIPES: 174

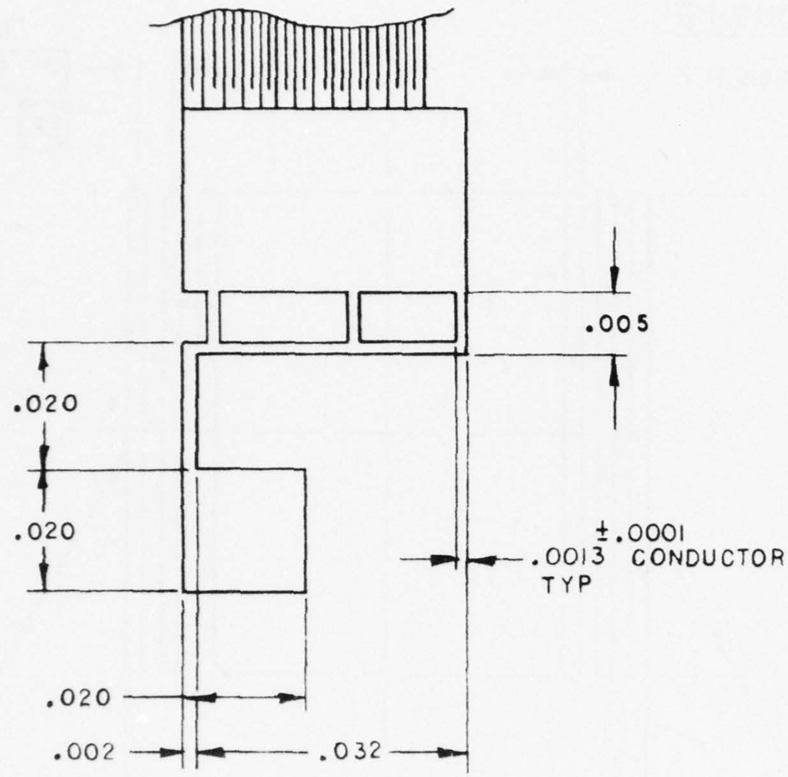
SIZE	FSCM NO.	DRAWING NO.	REV
A	05869	1950517	
SCALE:	NONE	SHEET	12



DETAIL C

SIZE	CODE IDENT NO.	DRAWING NO.	REV
A	05869	1950517	
SCALE NONE		SHEET 13	

11-061-1 CS-GS 10/73



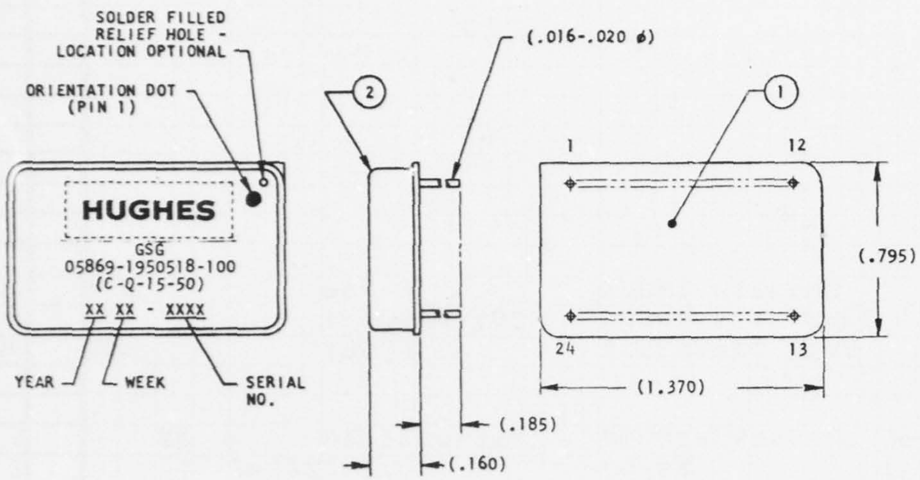
DETAIL D
(TYP)

SIZE	CODE IDENT NO.	DRAWING NO.	REV
A	05869	1950517	
SCALE NONE		SHEET 14	

11-061-1 CS-GS 10/73

92508-4

REVISIONS					
AUTHORITY	ZONE	LTR	DESCRIPTION	DATE	APPROVED
DDT 74356		-	PRODUCTION RELEASE	77-11-	



NOTES - UNLESS OTHERWISE SPECIFIED

1. FOR SCHEMATIC DIAGRAM SEE 1950519.
2. THIS ITEM SHALL MEET THE REQUIREMENTS OF 1950512-600.
3. IDENTIFICATION MARKING PER P80-3.
4. SEAL ASSEMBLY USING ITEM 3 OR BY PROJECTION WELDING (MFG OPTION).

SEE SEPARATE PARTS LIST

-	SAW MMT	EXCEPT AS NOTED DIM. ARE IN INCHES AND PER ANS Y14.5 .XXX .XX ANGLES ±.010 ±.03 ±0°30'
NEXT ASSY	USED ON	MATERIAL
APPLICATION		

CONTRACT: DAAB07-75-C-0044	HUGHES — HUGHES AIRCRAFT COMPANY FULLERTON, CALIFORNIA
DR L.Y. Amtake 77-10-28	DELAY LINE, SURFACE ACOUSTIC WAVE — CENTER FREQ 150 MHz, BANDWIDTH 50 MHz (PULSE COMPRESSION FILTER)
CHK K. Burns 77-10-29	SIZE B — CODE IDENT NO 05869 — DRAWING NO. 1950518-100 — REV
APPD 77-11-04	SCALE NONE — SHEET

11-063B-1 GS 7/73 — 12-66-42 — FORM 3

PARTS LIST TRANSMITTAL

HUGHES AIRCRAFT COMPANY
FULLERTON, CALIFORNIA

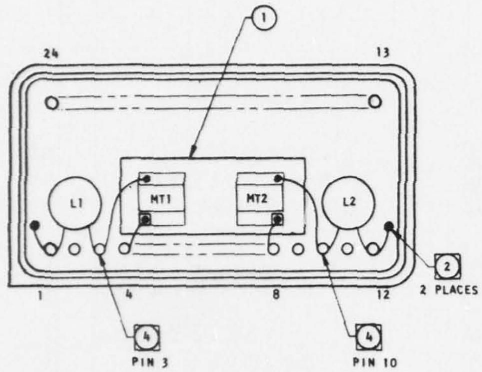
ISSUE: | ACTION: A | 10 CONTRACT: DAAB07-75-C-0044 | PL 1950518-100 | CODE IDENT: 05869 | 11 REV: - | YR MO DA: 77 09 23

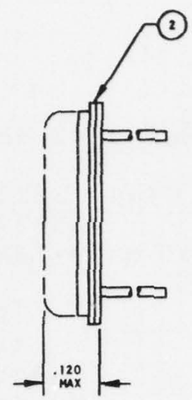
12 LIST TITLE: DELAY LINE, SAW | 13 MAINT: | 14 PROJECT: SAW MMT | 15 REFERENCE NO.: | 16 REV AUTH: | SHEET 1 OF 1

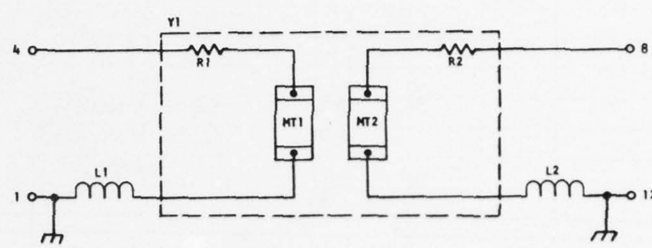
	ITEM NO.	LINE NO.	QUANTITY REQUIRED (20)	UNIT OF MEAS (21)	CODE IDENT (22)	PART OR IDENT NUMBER (23)	DESCRIPTION (24)	SPECIFICATION OR REFERENCE (25)	REF DESIGNATION FROM (26)	THRU (27)	AUTH (28)	WT LB (29)	
A	1		1			1950519	SUBASSY						
A	2		1		29172	20216	COVER	TEKFORM					
A	3		AR			4277250-996	SOLDER, SN961W5	QQ-S-571					
A	900		REF			1950519	SCHEMATIC DIAG						
A	901		REF			1950512-600	DESGN PERF SPEC						
A	902		REF			P80-3	IDENT MARKING						

PREPARED BY	DATE	CHECKED BY	DATE	APPROVED BY	DATE	APPROVED BY	DATE
H. Burns	77-09-23		77-	[illegible]	77-11-09		77-

AUTHORITY	LTR	DESCRIPTION	DATE	APPROVED
		REVISIONS		
DDT 74356	-	PRODUCTION RELEASE	77-11-16	[illegible]







SCHEMATIC DIAGRAM

NOTES - UNLESS OTHERWISE SPECIFIED:

1. ATTACH ITEM 1 TO ITEM 2 USING ITEM 7.
2. SOLDER LEADS OF L1 AND L2 TO HEADER AND HEADER PINS AS SHOWN USING ITEM 8.
3. ALL OTHER CONNECTIONS ARE WIRE BONDS PER MIL-STD-883, METHOD 2017 USING ITEM 6.
4. CLIP INDICATED PIN FLUSH WITH FAR SIDE OF HEADER.
5. (NOT USED)
6. TUNE L1 AND L2 TO MEET THE PERFORMANCE REQUIREMENTS OF 19500512-600 BY ADJUSTING SPACING BETWEEN TURNS. THEN BOND TO ITEM 2 USING ITEM 7.

SEE SEPARATE PARTS LIST

1950518-100	SAW HMT
NEXT ASSY	USED ON
APPLICATION	

EXCEPT AS NOTED DIM ARE IN INCHES AND PER ANSI Y14.5 .XXX .XX ANGLES $\pm.010$ $\pm.03$ $\pm0.5°$

MATERIAL

12-67-31

CONTRACT: DAAB07-75-C-0044

DR [signature] 77-11-0?

CHK [signature] 77-11-08

APPD [signature] 77-11-08

FORM 3

HUGHES

HUGHES AIRCRAFT COMPANY
FULLERTON, CALIFORNIA

DELAY LINE SUBASSEMBLY, SURFACE ACOUSTIC WAVE - CENTER FREQ 150 MHz, BANDWIDTH 50 MHz

SIZE	FSCM NO	DWG NO	REV
C	05869	1950519	
SCALE NONE		SHEET	

DWG NO 1950519 SH REV

FORM NO. 11064B-CS-GS REV. 7-76
DIETERICH-POST CLEARPRINT 1000H-10

PARTS LIST TRANSMITTAL

HUGHES AIRCRAFT COMPANY
FULLERTON, CALIFORNIA

ISSUE: | ACTION: A | 10 CONTRACT: DAAB07-75-C-0044 | PL 1950519 | CODE IDENT: 05869 | 11 DATE: 77 09 26 (YR MO DA)

12 LIST TITLE: DELAY LINE SUBASSY, SAW | 13 MAINT: | 14 PROJECT: MMT | 15 REFERENCE NO.: | 16 REV AUTH: | SHEET 1 OF 1

	ITEM NO.	LINE NO.	QUANTITY REQUIRED (20)	UNIT OF MEAS (21)	CODE IDENT (22)	PART OR IDENT NUMBER (23)	DESCRIPTION (24)	SPECIFICATION OR REFERENCE (25)	REF DESIGNATION FROM (26)	THRU (27)	AUTH (28)	WT LB (29)	PL NOTE
A	1		1			1950520	CRYSTAL		Y1				
A	2		1		29172	20221	HEADER	TEKFORM					
A	3		1		55167	850-6	COIL	CORONA MAG	L1				
A	4		1		55167	850-4	COIL	CORONA MAG	L2				
N	5												
A	6		AR			760660-11	WIRE, GOLD .001						
A	7		AR		71984	3140 RTV	ADHESIVE	DOW CORNING					
A	8		AR			4277250-999	SOLDER, SN63	QQ-S-571					
A	1900		REF			MIL-STD-883	WIRE BOND SPEC						

PREPARED BY: H. Burns | DATE: 77-09-26 | CHECKED BY: | DATE: 77- - | APPROVED BY: [signature] | DATE: 77-11-09 | APPROVED BY: | DATE: 77- -

HH-18 GS 12 70

1950520

REVISIONS				
AUTHORITY	LTR	DESCRIPTION	DATE	APPROVED
DDI 86948		PRODUCTION RELEASE	78-06-[illegible]	[illegible]

NOTES:

1. MATERIAL: QUARTZ PER 760781
2. FABRICATE PER 780294
3. DEPOSITION THICKNESS:
   0.20 ±0.01 μm
   (2000 ±100 Å)

4 INDICATES DIRECTION OF SPECIFIED CRYSTALLINE AXIS & PROPAGATION DIRECTION.

5 HORIZONTAL CENTERLINES OF MT1 & MT2 SHALL BE CO-LINEAR WITHIN AND PARALLEL TO X-AXIS WITHIN 0.25°.

6. IN DIMENSIONAL LISTINGS, THE NO. FOLLOWING THE LETTER E INDICATES THE POWER OF 10 BY WHICH THE NO. MUST BE MULTIPLIED TO OBTAIN THE CORRECT VALUE. FOR EXAMPLE:

   $1.45870E-02 = 1.45870 \times 10^{-2} = 0.014587$

   $1.34567E\ 00 = 1.34567 \times 10^{0} = 1.34567$

7 DEPOSITION FILM APPLIED IN INDICATED AREA.

8 INDICATED SURFACE TO BE CORRUGATED PER P82

9. BACK SURFACE TO BE ROUGHENED WITH #180 GRIT.

10 TO BE DETERMINED AT TIME OF FABRICATION.

FRAGILE ITEM (EASILY DAMAGED BY HANDLING) - TO BE INSTALLED IN NEXT ASSEMBLY AT POINT OF MANUFACTURE.

METRIC
THIRD ANGLE
(AMERICAN) PROJECTION

1950519	SAW-MMT		
NEXT ASSY	USED ON		
APPLICATION			

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN MILLIMETERS & PER ANSI Y14.5

.XXX ±0.002
.XX ±0.02
.X ±0.5
ANGLES ±2°

CONTRACT: DAAB07-75C-0044

DR [signature] 78-08-[illegible]
CHK
APPR [signature] 78-09-06

HUGHES — HUGHES AIRCRAFT COMPANY, FULLERTON, CALIFORNIA

CRYSTAL, SURFACE ACOUSTIC WAVE - DELAY LINE - 150 MHz CENTER FREQ., 50 MHz BANDWIDTH

SIZE	FSCM NO.	DWG NO.	REV
A	05869	1950520	
SCALE NONE	WT	SHEET 1 OF 20	

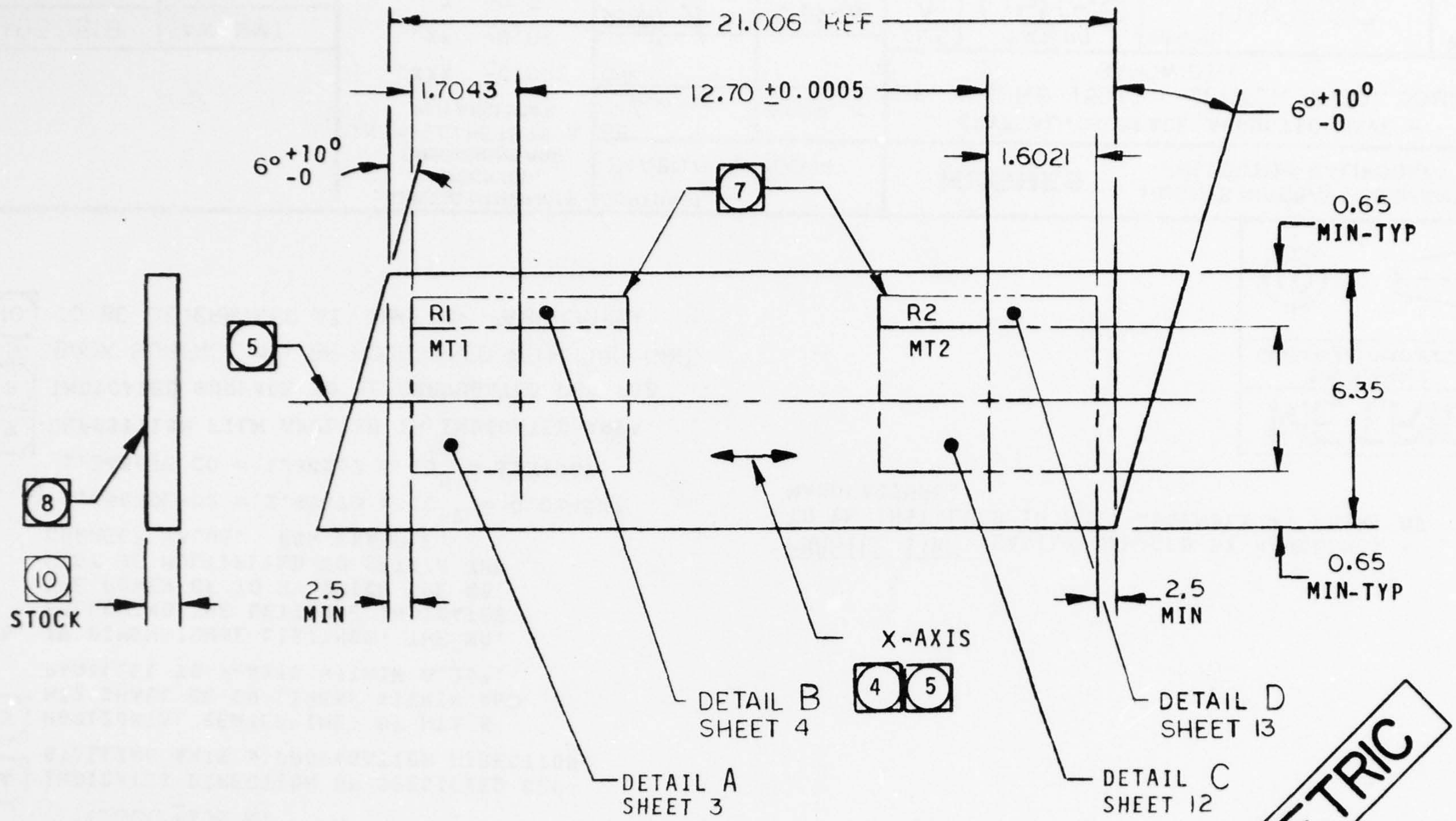
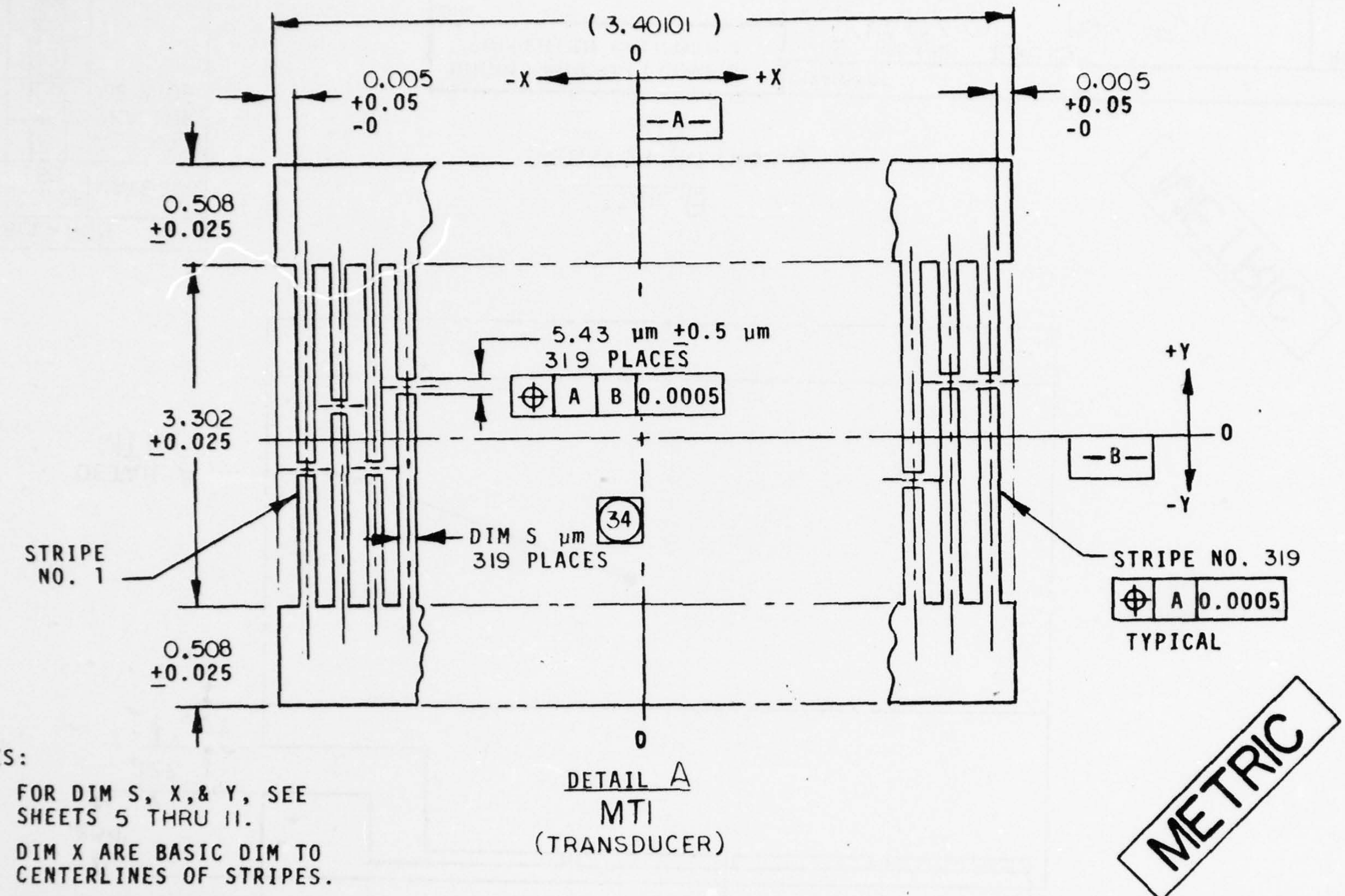


FIGURE 1

HUGHES AIRCRAFT COMPANY FULLERTON, CALIFORNIA	CONTRACT:			
	SIZE A	FSCM NO. 05869	DWG NO. 1950520	REV
DR				
ISSUED	SCALE NONE		SHEET 2	



DETAIL A
MTI
(TRANSDUCER)

NOTES:

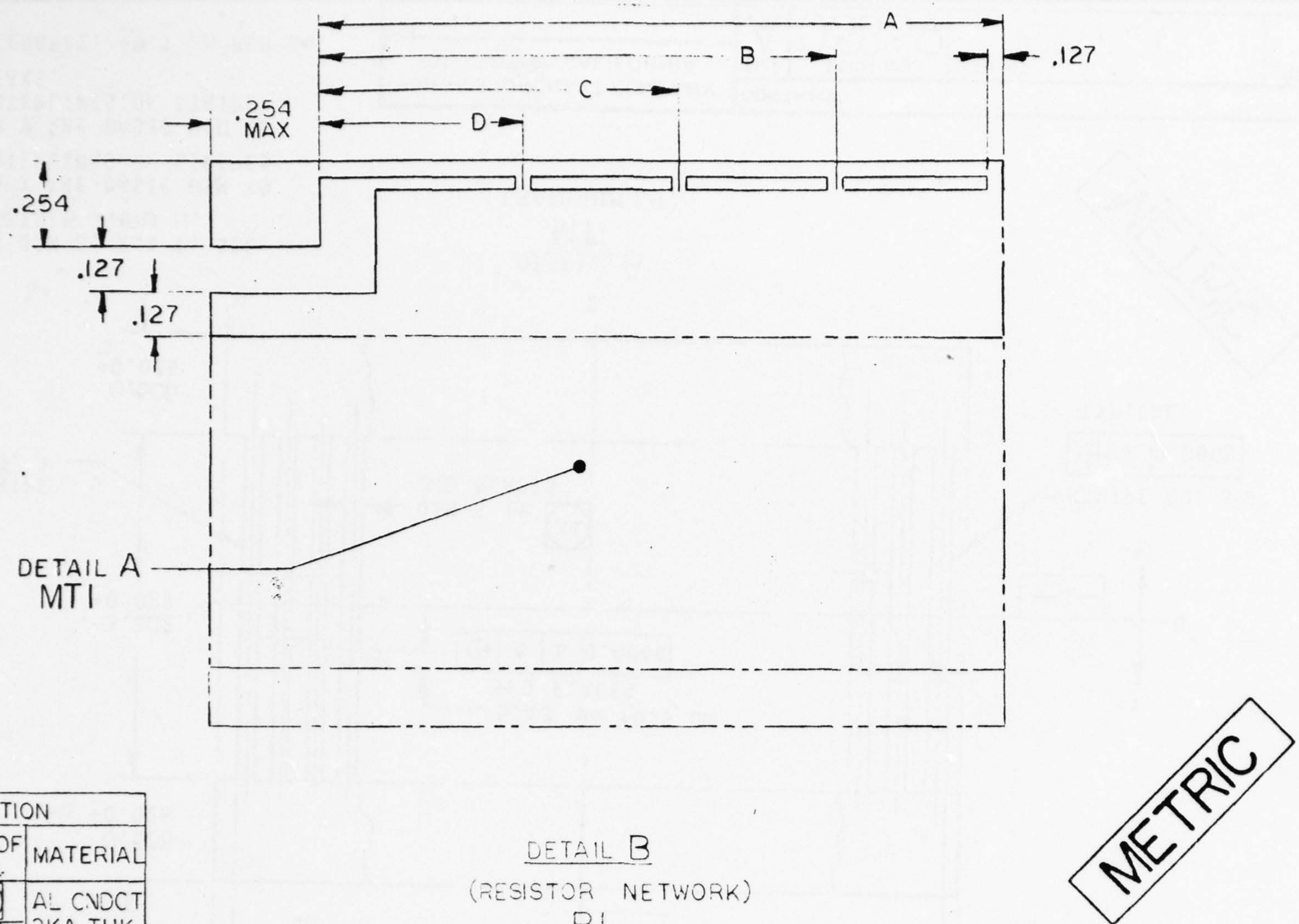
31. FOR DIM S, X, & Y, SEE SHEETS 5 THRU 11.

32. DIM X ARE BASIC DIM TO CENTERLINES OF STRIPES.

33. DIM Y ARE BASIC DIM TO CENTERLINES OF STRIPE BREAKS.

34. TOLERANCE: ±0.1 μm PER μm.

HUGHES AIRCRAFT COMPANY FULLERTON, CALIFORNIA	CONTRACT:			
DR	SIZE A	FSCM NO. 05869	DWG NO. 1950520	REV
ISSUED	SCALE NONE		SHEET 3	



DETAIL B
(RESISTOR NETWORK)
R1

TABULATION		
LENGTH	NO. OF SQ.	MATERIAL
A	10	AL CNDCT 2KA THK .02 WIDE
B	10	
C	10	
D	10	

HUGHES AIRCRAFT COMPANY FULLERTON, CALIFORNIA	CONTRACT			
DR	SIZE A	FSCM NO 05869	DWG NO. 1950520	REV
ISSUED	SCALE NONE		SHEET 4	

STRIPE NO.	DIM X STRIPE LOCATION	DIM Y BREAK LOCATION	DIM S STRIPE WIDTH
1	-1.67240E 00	1.16066E-05	6.38666E 00
2	-1.65963E 00	-9.24131E-04	6.37627E 00
3	-1.84689E 00	6.90036E-03	6.36592E 00
4	-1.63417E 00	-2.52713E-02	6.35563E 00
5	-1.62147E 00	6.48206E-02	6.34539E 00
6	-1.63879E 00	-1.33777E-01	6.33520E 00
7	-1.59613E 00	2.37680E-01	6.32505E 00
8	-1.58349E 00	-3.77527E-01	6.31495E 00
9	-1.57087E 00	5.49154E-01	6.30491E 00
10	-1.55827E 00	-7.42896E-01	6.29491E 00
11	-1.54569E 00	9.44315E-01	6.28496E 00
12	-1.53313E 00	-1.13620E 00	6.27505E 00
13	-1.52059E 00	1.30075E 00	6.26520E 00
14	-1.50807E 00	-1.42184E 00	6.25538E 00
15	-1.49557E 00	1.48711E 00	6.24562E 00
16	-1.48309E 00	-1.49664E 00	6.23589E 00
17	-1.47062E 00	1.49664E 00	6.22622E 00
18	-1.45818E 00	-1.49664E 00	6.21659E 00
19	-1.44576E 00	1.49664E 00	6.20700E 00
20	-1.43335E 00	-1.49664E 00	6.19746E 00
21	-1.42097E 00	1.49664E 00	6.18796E 00
22	-1.40860E 00	-1.49664E 00	6.17851E 00
23	-1.39625E 00	1.49664E 00	6.16910E 00
24	-1.38392E 00	-1.49664E 00	6.15973E 00
25	-1.37161E 00	1.49664E 00	6.15040E 00
26	-1.35932E 00	-1.49664E 00	6.14112E 00
27	-1.34705E 00	1.49664E 00	6.13188E 00
28	-1.33479E 00	-1.49664E 00	6.12267E 00
29	-1.32256E 00	1.49664E 00	6.11352E 00
30	-1.31034E 00	-1.49664E 00	6.10440E 00
31	-1.29814E 00	1.49664E 00	6.09532E 00
32	-1.28596E 00	-1.49664E 00	6.08629E 00
33	-1.27380E 00	1.49664E 00	6.07729E 00
34	-1.26165E 00	-1.49664E 00	6.06833E 00
35	-1.24952E 00	1.49664E 00	6.05942E 00
36	-1.23741E 00	-1.49664E 00	6.05054E 00
37	-1.22532E 00	1.49664E 00	6.04170E 00
38	-1.21325E 00	-1.49664E 00	6.03290E 00
39	-1.20119E 00	1.49664E 00	6.02413E 00
40	-1.18915E 00	-1.49664E 00	6.01541E 00
41	-1.17713E 00	1.49664E 00	6.00672E 00
42	-1.16512E 00	-1.49664E 00	5.99808E 00
43	-1.15313E 00	1.49664E 00	5.98947E 00
44	-1.14116E 00	-1.49644E 00	5.98089E 00
45	-1.12921E 00	1.49664E 00	5.97235E 00
46	-1.11727E 00	-1.49664E 00	5.96385E 00
47	-1.10536E 00	1.49664E 00	5.95539E 00
48	-1.09345E 00	-1.49664E 00	5.94696E 00
49	-1.08157E 00	1.49664E 00	5.93856E 00
50	-1.06976E 00	-1.49664E 00	5.93020E 00

TRANSDUCER NAME: ECOMMT PCQ, UNAPODIZED TRANSDUCER
DATE: JAN 18, 1978
REF DES: MT1
TOTAL NUMBER OF ELECTRODE STRIPES: 319

SIZE	FSCM NO.	DRAWING NO.	REV
A	05869	1950520	
SCALE:	NONE	SHEET	5

STRIPE NO.	DIM X STRIPE LOCATION	DIM Y BREAK LOCATION	DIM S STRIPE WIDTH
51	-1.05785E 00	1.49664E 00	5.92188E 00
52	-1.04601E 00	-1.49664E 00	5.91360E 00
53	-1.03419E 00	1.49664E 00	5.90534E 00
54	-1.02239E 00	-1.49664E 00	5.89712E 00
55	-1.01060E 00	1.49664E 00	5.88894E 00
56	-9.98834E-01	-1.49664E 00	5.88079E 00
57	-9.87081E-01	1.49664E 00	5.87267E 00
58	-9.75344E-01	-1.49664E 00	5.86459E 00
59	-9.63623E-01	1.49664E 00	5.85654E 00
60	-9.51918E-01	-1.49664E 00	5.84852E 00
61	-9.40228E-01	1.49664E 00	5.84054E 00
62	-9.28555E-01	-1.49664E 00	5.83258E 00
63	-9.16898E-01	1.49664E 00	5.82466E 00
64	-9.05257E-01	-1.49664E 00	5.81678E 00
65	-8.93631E-01	1.49664E 00	5.80892E 00
66	-8.82021E-01	-1.49664E 00	5.80110E 00
67	-8.70427E-01	1.49664E 00	5.79330E 00
68	-8.58848E-01	-1.49664E 00	5.78554E 00
69	-8.47284E-01	1.49664E 00	5.77781E 00
70	-8.35736E-01	-1.49664E 00	5.77012E 00
71	-8.24204E-01	1.49664E 00	5.76245E 00
72	-8.12687E-01	-1.49664E 00	5.75481E 00
73	-8.01185E-01	1.49664E 00	5.74721E 00
74	-7.89698E-01	-1.49664E 00	5.73962E 00
75	-7.78226E-01	1.49664E 00	5.73208E 00
76	-7.66769E-01	-1.49664E 00	5.72456E 00
77	-7.55328E-01	1.49664E 00	5.71708E 00
78	-7.43901E-01	-1.49664E 00	5.70961E 00
79	-7.32489E-01	1.49664E 00	5.70219E 00
80	-7.21092E-01	-1.49664E 00	5.69479E 00
81	-7.09710E-01	1.49664E 00	5.68742E 00
82	-6.98343E-01	-1.49664E 00	5.68007E 00
83	-6.86990E-01	1.49664E 00	5.67276E 00
84	-6.75651E-01	-1.49664E 00	5.66547E 00
85	-6.64328E-01	1.49664E 00	5.65821E 00
86	-6.53019E-01	-1.49664E 00	5.65098E 00
87	-6.41724E-01	1.49664E 00	5.64378E 00
88	-6.30443E-01	-1.49664E 00	5.63660E 00
89	-6.19177E-01	1.49664E 00	5.62945E 00
90	-6.07926E-01	-1.49664E 00	5.62233E 00
91	-5.96688E-01	1.49664E 00	5.61523E 00
92	-5.85465E-01	-1.49664E 00	5.60817E 00
93	-5.74255E-01	1.49664E 00	5.60113E 00
94	-5.63060E-01	-1.49664E 00	5.59412E 00
95	-5.51879E-01	1.49664E 00	5.58712E 00
96	-5.40712E-01	-1.49664E 00	5.58016E 00
97	-5.29558E-01	1.49664E 00	5.57323E 00
98	-5.18419E-01	-1.49664E 00	5.56631E 00
99	-5.07293E-01	1.49664E 00	5.55943E 00
100	-4.96181E-01	-1.49664E 00	5.55257E 00

TRANSDUCER NAME: ECOMMT PCQ, UNAPODIZED TRANSDUCER
DATE: JAN 18, 1978
REF DES: MT1
TOTAL NUMBER OF ELECTRODE STRIPES: 319

SIZE	FSCM NO.	DRAWING NO.	REV
A	05869	1950520	
SCALE:	NONE	SHEET	6

STRIPE NO.	DIM X STRIPE LOCATION	DIM Y BREAK LOCATION	DIM S STRIPE WIDTH
101	-4.85083E-01	1.49664E 00	5.54574E 00
102	-4.73998E-01	-1.49664E 00	5.53893E 00
103	-4.62927E-01	1.49664E 00	5.53215E 00
104	-4.51869E-01	-1.49664E 00	5.52539E 00
105	-4.40825E-01	1.49664E 00	5.51865E 00
106	-4.29795E-01	-1.49664E 00	5.51195E 00
107	-4.18777E-01	1.49664E 00	5.50526E 00
108	-4.07773E-01	-1.49664E 00	5.49860E 00
109	-3.96783E-01	1.49664E 00	5.49196E 00
110	-3.85806E-01	-1.49664E 00	5.48534E 00
111	-3.74842E-01	1.49664E 00	5.47876E 00
112	-3.63891E-01	-1.49664E 00	5.47220E 00
113	-3.52953E-01	1.49664E 00	5.46565E 00
114	-3.42028E-01	-1.49664E 00	5.45913E 00
115	-3.31116E-01	1.49664E 00	5.45264E 00
116	-3.20217E-01	-1.49664E 00	5.44617E 00
117	-3.09331E-01	1.49664E 00	5.43972E 00
118	-2.98458E-01	-1.49664E 00	5.43329E 00
119	-2.87598E-01	1.49664E 00	5.42689E 00
120	-2.76751E-01	-1.49664E 00	5.42051E 00
121	-2.65916E-01	1.49664E 00	5.41415E 00
122	-2.55094E-01	-1.49664E 00	5.40781E 00
123	-2.44285E-01	1.49664E 00	5.40150E 00
124	-2.33488E-01	-1.49664E 00	5.39521E 00
125	-2.22704E-01	1.49664E 00	5.38894E 00
126	-2.11932E-01	-1.49664E 00	5.38269E 00
127	-2.01173E-01	1.49664E 00	5.37646E 00
128	-1.90427E-01	-1.49664E 00	5.37026E 00
129	-1.79692E-01	1.49664E 00	5.36407E 00
130	-1.68970E-01	-1.49664E 00	5.35791E 00
131	-1.58260E-01	1.49664E 00	5.35177E 00
132	-1.47563E-01	-1.49664E 00	5.34565E 00
133	-1.36878E-01	1.49664E 00	5.33955E 00
134	-1.26205E-01	-1.49664E 00	5.33348E 00
135	-1.15544E-01	1.49664E 00	5.32742E 00
136	-1.04895E-01	-1.49664E 00	5.32138E 00
137	-9.42584E-01	1.49664E 00	5.31537E 00
138	-8.36336E-01	-1.49664E 00	5.30937E 00
139	-7.30209E-02	1.49664E 00	5.30339E 00
140	-6.24200E-02	-1.49664E 00	5.29744E 00
141	-5.18311E-02	1.49664E 00	5.29150E 00
142	-4.12540E-02	-1.49664E 00	5.28559E 00
143	-3.06887E-02	1.49664E 00	5.27969E 00
144	-2.01352E-02	-1.49664E 00	5.27382E 00
145	-9.59342E-03	1.49664E 00	5.26796E 00
146	9.36670E-04	-1.49664E 00	5.26213E 00
147	1.14551E-02	1.49664E 00	5.25631E 00
148	2.19619E-02	-1.49664E 00	5.25051E 00
149	3.24572E-02	1.49664E 00	5.24473E 00
150	4.29409E-02	-1.49664E 00	5.23897E 00

TRANSDUCER NAME: ECOMMT PCQ, UNAPODIZED TRANSDUCER
DATE: JAN 18, 1978
REF DES: MT1
TOTAL NUMBER OF ELECTRODE STRIPES: 319

SIZE	FSCM NO.	DRAWING NO.	REV
A	05869	1950520	
SCALE: NONE		SHEET	7

STRIPE NO.	DIM X STRIPE LOCATION	DIM Y BREAK LOCATION	DIM S STRIPE WIDTH
151	5.34131E-02	1.49664E 00	5.23323E 00
152	6.38738E-02	-1.49664E 00	5.22751E 00
153	7.43231E-02	1.49664E 00	5.22180E 00
154	8.47610E-02	-1.49664E 00	5.21612E 00
155	9.51876E-02	1.49664E 00	5.21045E 00
156	1.05603E-01	-1.49664E 00	5.20480E 00
157	1.16007E-01	1.49664E 00	5.19917E 00
158	1.26400E-01	-1.49664E 00	5.19356E 00
159	1.36781E-01	1.49664E 00	5.18797E 00
160	1.47151E-01	-1.49664E 00	5.18239E 00
161	1.57511E-01	1.49664E 00	5.17683E 00
162	1.67859E-01	-1.49664E 00	5.17130E 00
163	1.78196E-01	1.49664E 00	5.16577E 00
164	1.88522E-01	-1.49664E 00	5.16027E 00
165	1.98837E-01	1.49664E 00	5.15478E 00
166	2.09141E-01	-1.49664E 00	5.14931E 00
167	2.19434E-01	1.49664E 00	5.14386E 00
168	2.29717E-01	-1.49664E 00	5.13843E 00
169	2.39988E-01	1.49664E 00	5.13301E 00
170	2.50249E-01	-1.49664E 00	5.12761E 00
171	2.60498E-01	1.49664E 00	5.12222E 00
172	2.70738E-01	-1.49664E 00	5.11686E 00
173	2.80966E-01	1.49664E 00	5.11151E 00
174	2.91184E-01	-1.49664E 00	5.10618E 00
175	3.01391E-01	1.49664E 00	5.10086E 00
176	3.11587E-01	-1.49664E 00	5.09556E 00
177	3.21773E-01	1.49664E 00	5.09028E 00
178	3.31948E-01	-1.49664E 00	5.08501E 00
179	3.42113E-01	1.49664E 00	5.07976E 00
180	3.52267E-01	-1.49664E 00	5.07453E 00
181	3.62411E-01	1.49664E 00	5.06931E 00
182	3.72545E-01	-1.49664E 00	5.06411E 00
183	3.82668E-01	1.49664E 00	5,05892E 00
184	3.92780E-01	-1.49664E 00	5.05375E 00
185	4.02883E-01	1.49664E 00	5.04860E 00
186	4.12975E-01	-1.49664E 00	5.04346E 00
187	4.23056E-01	1.49664E 00	5.03834E 00
188	4.33128E-01	-1.49664E 00	5.03323E 00
189	4.43189E-01	1.49664E 00	5.02814E 00
190	4.53241E-01	-1.49664E 00	5.02306E 00
191	4.63282E-01	1.49664E 00	5.01800E 00
192	4.73313E-01	-1.49664E 00	5.01295E 00
193	4.83334E-01	1.49664E 00	5.00792E 00
194	4.93344E-01	-1.49664E 00	5.00291E 00
195	5.03345E-01	1.49664E 00	4.99791E 00
196	5.13336E-01	-1.49664E 00	4.99292E 00
197	5.23317E-01	1.49664E 00	4.98795E 00
198	5.33288E-01	-1.49664E 00	4.98300E 00
199	5.43249E-01	1.49664E 00	4.97805E 00
200	5.53200E-01	-1.49664E 00	4.97313E 00

TRANSDUCER NAME: ECOMMT PCQ, UNAPODIZED TRANSDUCER
DATE: JAN 18, 1978
REF DES: MT1
TOTAL NUMBER OF ELECTRODE STRIPES: 319

SIZE	FSCM NO.	DRAWING NO.	REV
A	05869	1950520	
SCALE: NONE		SHEET	8

STRIPE NO.	DIM X STRIPE LOCATION	DIM Y BREAK LOCATION	DIM S STRIPE WIDTH
201	5.83141E-01	1.49664E 00	4.96822E 00
202	5.73073E-01	-1.49664E 00	4.96332E 00
203	5.82995E-01	1.49664E 00	4.95844E 00
204	5.92907E-01	-1.49664E 00	4.95357E 00
205	6.82809E-01	1.49664E 00	4.94871E 00
206	6.12702E-01	-1.49664E 00	4.94387E 00
207	6.22585E-01	1.49664E 00	4.93905E 00
208	6.32458E-01	-1.49664E 00	4.93424E 00
209	6.42322E-01	1.49664E 00	4.92944E 00
210	6.52176E-01	-1.49664E 00	4.92465E 00
211	6.62028E-01	1.49664E 00	4.91989E 00
212	6.71855E-01	-1.49664E 00	4.91513E 00
213	6.81681E-01	1.49664E 00	4.91039E 00
214	6.91497E-01	-1.49664E 00	4.90566E 00
215	7.01303E-01	1.49664E 00	4.90095E 00
216	7.11101E-01	-1.49664E 00	4.89625E 00
217	7.20888E-01	1.49664E 00	4.89156E 00
218	7.30667E-01	-1.49664E 00	4.88688E 00
219	7.40436E-01	1.49664E 00	4.88222E 00
220	7.50196E-01	-1.49664E 00	4.87757E 00
221	7.59946E-01	1.49664E 00	4.87294E 00
222	7.69888E-01	-1.49664E 00	4.86832E 00
223	7.79429E-01	1.49664E 00	4.86371E 00
224	7.89142E-01	-1.49664E 00	4.85912E 00
225	7.98856E-01	1.49664E 00	4.85453E 00
226	8.08561E-01	-1.49664E 00	4.84997E 00
227	8.18256E-01	1.49664E 00	4.84541E 00
228	8.27942E-01	-1.49664E 00	4.84087E 00
229	8.37619E-01	1.49664E 00	4.83634E 00
230	8.47288E-01	-1.49664E 00	4.83182E 00
231	8.56947E-01	1.49664E 00	4.82731E 00
232	8.66597E-01	-1.49664E 00	4.82282E 00
233	8.76238E-01	1.49664E 00	4.81834E 00
234	8.85870E-01	-1.49664E 00	4.81387E 00
235	8.95494E-01	1.49664E 00	4.80942E 00
236	9.05108E-01	-1.49664E 00	4.80498E 00
237	9.14714E-01	1.49664E 00	4.80054E 00
238	9.24310E-01	-1.49664E 00	4.79612E 00
239	9.33898E-01	1.49664E 00	4.79172E 00
240	9.43477E-01	-1.49664E 00	4.78733E 00
241	9.53047E-01	1.49664E 00	4.78294E 00
242	9.62609E-01	-1.49664E 00	4.77857E 00
243	9.72162E-01	1.49664E 00	4.77422E 00
244	9.81706E-01	-1.49664E 00	4.76987E 00
245	9.91241E-01	1.49664E 00	4.76554E 00
246	1.00077E 00	-1.49664E 00	4.76121E 00
247	1.01029E 00	1.49664E 00	4.75690E 00
248	1.01980E 00	-1.49664E 00	4.75260E 00
249	1.02930E 00	1.49664E 00	4.74831E 00
250	1.03879E 00	-1.49664E 00	4.74404E 00

TRANSDUCER NAME: ECOMMT PCQ, UNAPODIZED TRANSDUCER
DATE: JAN 18, 1978
REF DES: MT1
TOTAL NUMBER OF ELECTRODE STRIPES: 319

SIZE	FSCM No.	DRAWING NO.	REV
A	05869	1950520	
SCALE:	NONE	SHEET	9

STRIPE NO.	DIM X STRIPE LOCATION	DIM Y BREAK LOCATION	DIM S STRIPE WIDTH
251	1.04827E 00	1.49664E 00	4.73978E 00
252	1.05775E 00	-1.49664E 00	4.73552E 00
253	1.06721E 00	1.49664E 00	4.73128E 00
254	1.07667E 00	-1.49644E 00	4.72705E 00
255	1.08612E 00	1.49664E 00	4.72283E 00
256	1.09556E 00	-1.49664E 00	4.71863E 00
257	1.10500E 00	1.49664E 00	4.71443E 00
258	1.11442E 00	-1.49664E 00	4.71025E 00
259	1.12384E 00	1.49664E 00	4.70607E 00
260	1.13325E 00	-1.49664E 00	4.70191E 00
261	1.14265E 00	1.49664E 00	4.69775E 00
262	1.15204E 00	-1.49664E 00	4.69362E 00
263	1.16142E 00	1.49664E 00	4.68948E 00
264	1.17080E 00	-1.49664E 00	4.68537E 00
265	1.18016E 00	1.49664E 00	4.68126E 00
266	1.18952E 00	-1.49644E 00	4.67716E 00
267	1.19887E 00	1.49664E 00	4.67307E 00
268	1.20821E 00	-1.49664E 00	4.66900E 00
269	1.21755E 00	1.49664E 00	4.66494E 00
270	1.22687E 00	-1.49664E 00	4.66088E 00
271	1.23619E 00	1.49664E 00	4.65683E 00
272	1.24550E 00	-1.49664E 00	4.65280E 00
273	1.25480E 00	1.49664E 00	4.64878E 00
274	1.26409E 00	-1.49664E 00	4.64477E 00
275	1.27338E 00	1.49664E 00	4.64076E 00
276	1.28266E 00	-1.49664E 00	4.63677E 00
277	1.29193E 00	1.49664E 00	4.63279E 00
278	1.30119E 00	-1.49664E 00	4.62882E 00
279	1.31044E 00	1.49664E 00	4.62485E 00
280	1.31969E 00	-1.49664E 00	4.62091E 00
281	1.32893E 00	1.49664E 00	4.61696E 00
282	1.33816E 00	-1.49664E 00	4.61303E 00
283	1.34738E 00	1.49664E 00	4.60911E 00
284	1.35659E 00	-1.49664E 00	4.60520E 00
285	1.36580E 00	1.49664E 00	4.60130E 00
286	1.37500E 00	-1.49664E 00	4.59741E 00
287	1.38419E 00	1.49664E 00	4.59353E 00
288	1.39337E 00	-1.49664E 00	4.58966E 00
289	1.40855E 00	1.49664E 00	4.58579E 00
290	1.41172E 00	-1.49664E 00	4.58194E 00
291	1.42088E 00	1.49664E 00	4.57810E 00
292	1.43003E 00	-1.49664E 00	4.57427E 00
293	1.43917E 00	1.49664E 00	4.57044E 00
294	1.44831E 00	-1.49664E 00	4.56663E 00
295	1.45744E 00	1.49664E 00	4.56283E 00
296	1.46656E 00	-1.49664E 00	4.55903E 00
297	1.47567E 00	1.49664E 00	4.55525E 00
298	1.48478E 00	-1.49664E 00	4.55147E 00
299	1.49388E 00	1.49122E 00	4.54770E 00
300	1.50297E 00	-1.45565E 00	4.54395E 00

TRANSFER NAME: ECOMMT PCQ, UNAPODIZED TRANSDUCER
DATE: JAN 18, 1978
REF DES: MT1
TOTAL NUMBER OF ELECTRODE STRIPES: 319

SIZE	FSCM NO.	DRAWING NO.	REV
A	05869	1950520	
SCALE:	NONE	SHEET	10

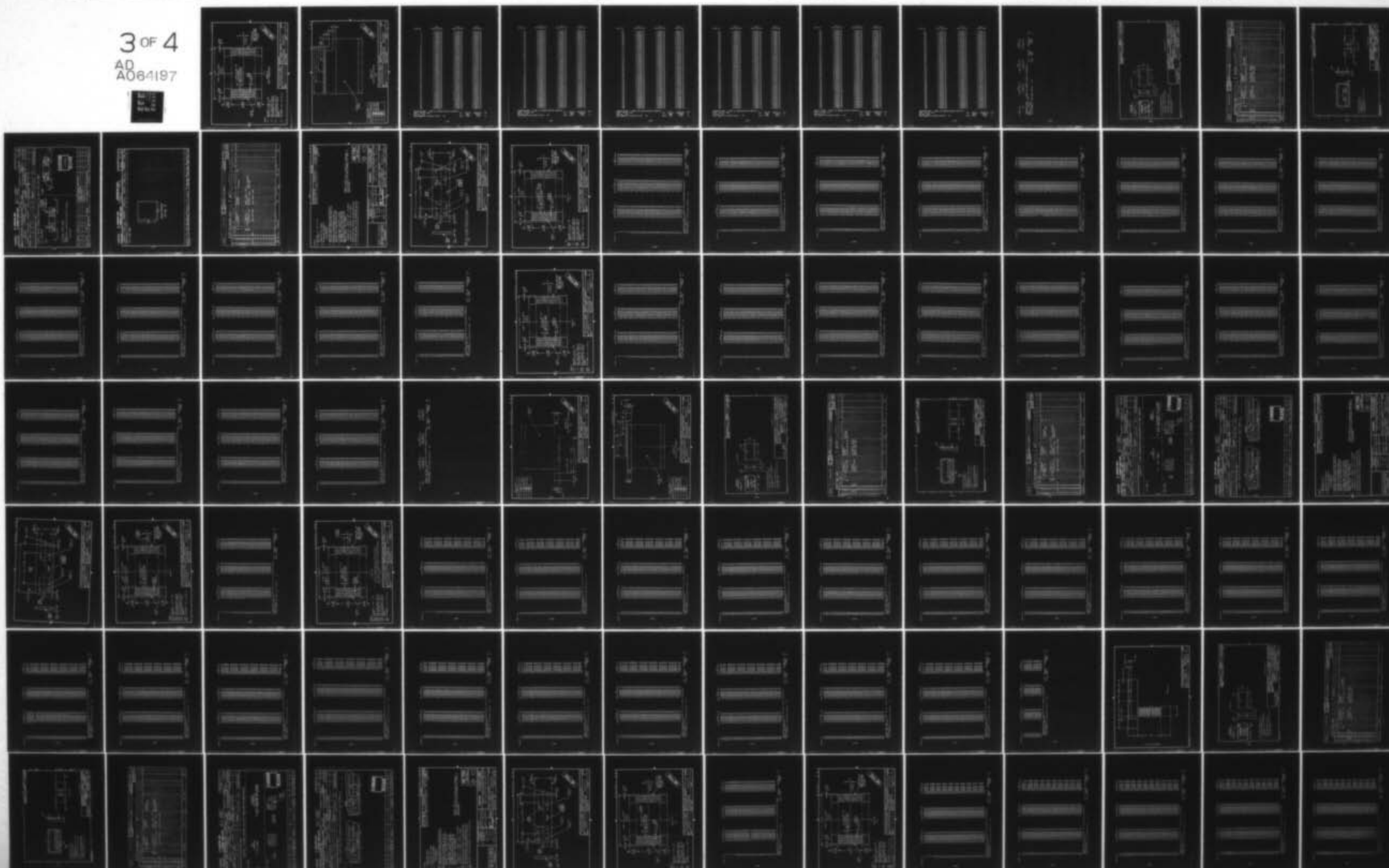
STRIPE NO.	DIM X STRIKE LOCATION	DIM Y BREAK LOCATION	DIM S STRIPE WIDTH
301	1.51206E 00	1.38878E 00	4.54020E 00
302	1.52113E 00	-1.29439E 00	4.53646E 00
303	1.53020E 00	1.17763E 00	4.53273E 00
304	1.53926E 00	-1.04469E 00	4.52901E 00
305	1.54832E 00	8.02266E-01	4.52530E 00
306	1.55737E 00	-7.57184E-01	4.52160E 00
307	1.56641E 00	6.15825E-01	4.51791E 00
308	1.57544E 00	-4.83785E-01	4.51422E 00
309	1.58446E 00	3.65494E-01	4.51055E 00
310	1.59348E 00	-2.64001E-01	4.50689E 00
311	1.60249E 00	1.80876E-01	4.50323E 00
312	1.61149E 00	-1.16260E-01	4.49958E 00
313	1.62049E 00	6.90074E-02	4.49594E 00
314	1.62948E 00	-3.69312E-02	4.49231E 00
315	1.63846E 00	1.71460E-02	4.48869E 00
316	1.64743E 00	-6.45227E-03	4.48508E 00
317	1.65640E 00	1.71398E-03	4.48147E 00
318	1.66536E 00	-2.25074E-04	4.47788E 00
219	1.67431E 00	2.29517E-06	4.47429E 00

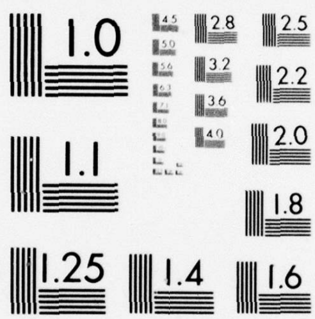
TRANSDUCER NAME: ECOMMT PCQ, UNAPODIZED TRANSDUCER
DATE: JAN 18, 1978
REF DES: MT1
TOTAL NUMBER OF ELECTRODE STRIPES: 319

SIZE	FSCM NO.	DRAWING NO.	REV
A	05869	1950520	
SCALE:	NONE	SHEET	11

AD-A064 197 HUGHES AIRCRAFT CO FULLERTON CALIF GROUND SYSTEMS GROUP F/G 9/5
PHOTOLITHOGRAPHIC TECHNIQUES FOR SURFACE ACOUSTIC WAVE (SAW) DE--ETC(U)
DEC 78 A W DOZIER DAAB07-75-C-0044
UNCLASSIFIED FR-79-12-40-VOL-1 DELET-TR-75-0044-F-VOL-1 NL

3 OF 4
AD
A064197

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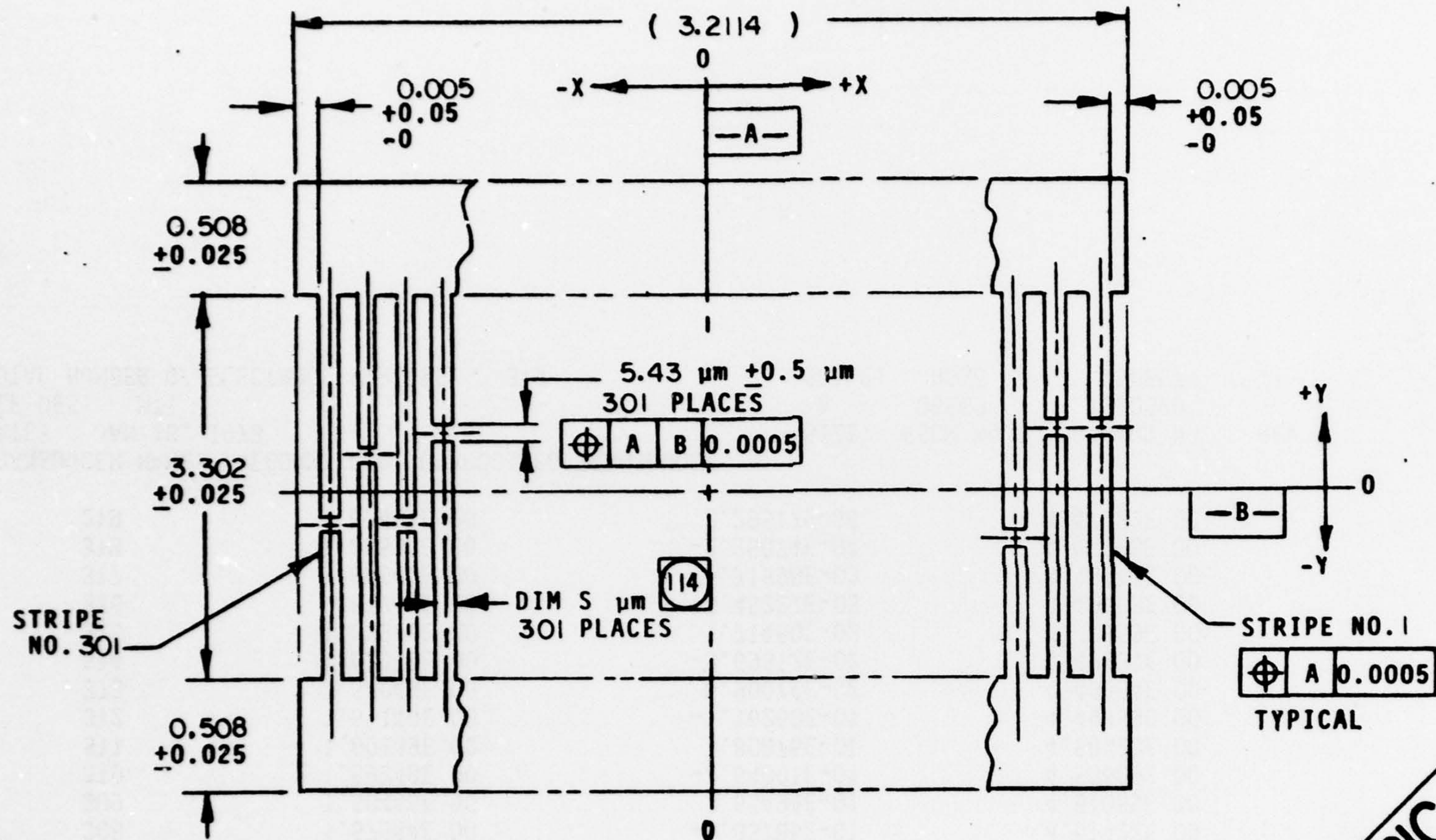


DETAIL C
MT2 (TRANSDUCER)

METRIC

NOTES:

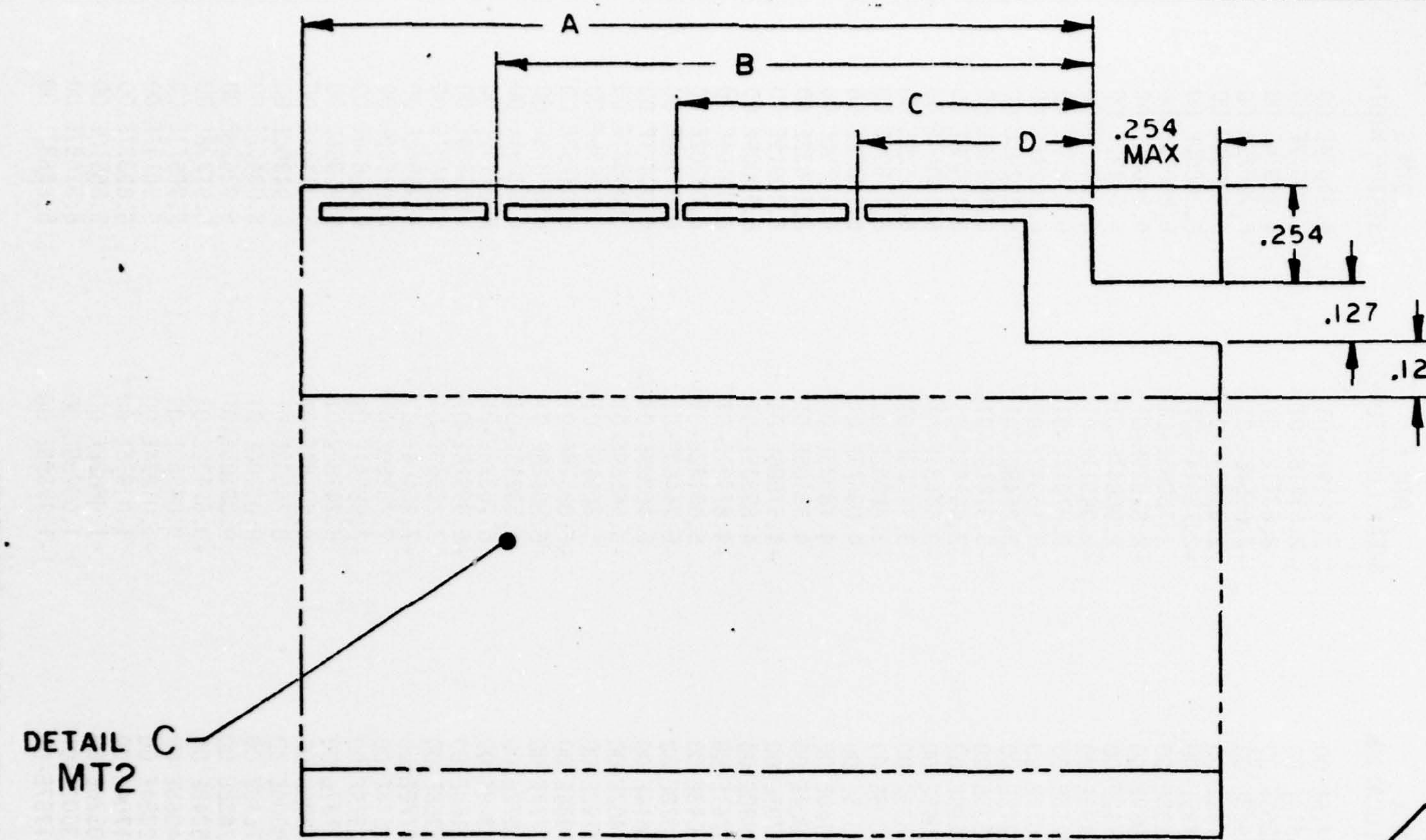
111. FOR DIM S, X, & Y, SEE SHEETS 14 THRU 20.

112. DIM X ARE BASIC DIM TO CENTERLINES OF STRIPES.

113. DIM Y ARE BASIC DIM TO CENTERLINES OF STRIPE BREAKS.

114. TOLERANCE: ±0.1 µm PER µm.

HUGHES AIRCRAFT COMPANY FULLERTON, CALIFORNIA	CONTRACT:			
	SIZE A	FSCM NO. 05869	DWG NO. 1950520	REV
DR				
ISSUED	SCALE NONE		SHEET 12	



TABULATION		
LENGTH	NO. OF SQ	MATERIAL
A	10	AL CNDCT 2KA THK .02 WIDE
B	10	
C	10	
D	10	

DETAIL D
(RESISTOR NETWORK)
R2

METRIC

HUGHES AIRCRAFT COMPANY FULLERTON, CALIFORNIA	CONTRACT			
DR	SIZE A	FSCM NO 05869	DWG NO. 1950520	REV
ISSUED	SCALE NONE		SHEET 13	

STRIPE NO.	DIM X STRIPE LOCATION	DIM Y BREAK LOCATION	DIM S STRIPE WIDTH
1	-1.57775E 00	2.61195E-01	6.31014E 00
2	-1.56514E 00	-2.61718E-01	6.30012E 00
3	-1.55255E 00	2.63172E-01	6.29014E 00
4	-1.53998E 00	-2.65546E-01	6.28022E 00
5	-1.52742E 00	2.68829E-01	6.27034E 00
6	-1.51489E 00	-2.73014E-01	6.26050E 00
7	-1.50238E 00	2.78085E-01	6.25072E 00
8	-1.48989E 00	-2.84035E-01	6.24097E 00
9	-1.47742E 00	2.90847E-01	6.23127E 00
10	-1.46496E 00	-2.98511E-01	6.22162E 00
11	-1.45253E 00	3.07012E-01	6.21201E 00
12	-1.44012E 00	-3.16343E-01	6.20245E 00
13	-1.42772E 00	3.26480E-01	6.19293E 00
14	-1.41535E 00	-3.37419E-01	6.18346E 00
15	-1.40299E 00	3.49145E-01	6.17402E 00
16	-1.39065E 00	-3.61631E-01	6.16464E 00
17	-1.37833E 00	3.74883E-01	6.15529E 00
18	-1.36603E 00	-3.88862E-01	6.14599E 00
19	-1.35375E 00	4.03577E-01	6.13672E 00
20	-1.34148E 00	-4.18993E-01	6.12750E 00
21	-1.32924E 00	4.35105E-01	6.11832E 00
22	-1.31701E 00	-4.51886E-01	6.10919E 00
23	-1.30480E 00	4.69335E-01	6.10009E 00
24	-1.29261E 00	-4.87421E-01	6.09104E 00
25	-1.28043E 00	5.06142E-01	6.08202E 00
26	-1.26828E 00	-5.25463E-01	6.07304E 00
27	-1.25614E 00	5.45385E-01	6.06411E 00
28	-1.24402E 00	-5.65869E-01	6.05521E 00
29	-1.23192E 00	5.86919E-01	6.04635E 00
30	-1.21984E 00	-6.08518E-01	6.03753E 00
31	-1.20777E 00	6.30628E-01	6.02875E 00
32	-1.19572E 00	-6.53245E-01	6.02001E 00
33	-1.18369E 00	6.76356E-01	6.01130E 00
34	-1.17168E 00	-6.99918E-01	6.00264E 00
35	-1.15968E 00	7.23949E-01	5.99401E 00
36	-1.14770E 00	-7.48404E-01	5.98542E 00
37	-1.13574E 00	7.73280E-01	5.97686E 00
38	-1.12379E 00	-7.98541E-01	5.96834E 00
39	-1.11187E 00	8.24182E-01	5.95986E 00
40	-1.09995E 00	-8.50188E-01	5.95141E 00
41	-1.08806E 00	8.76533E-01	5.94300E 00
42	-1.07618E 00	-9.03206E-01	5.93462E 00
43	-1.07432E 00	9.30185E-01	5.92628E 00
44	-1.05248E 00	-9.57432E-01	5.91798E 00
45	-1.04065E 00	9.84960E-01	5.90971E 00
46	-1.02884E 00	-1.01274E 00	5.90147E 00
47	-1.01704E 00	1.04075E 00	5.89327E 00
48	-1.00526E 00	-1.06898E 00	5.88510E 00
49	-9.93503E-01	1.09739E 00	5.87697E 00
50	-9.81757E-01	-1.12599E 00	5.86887E 00

TRANSDUCER NAME: ECOMMT PCQ FAMMING APODIZED TRANSDUCER
DATE: JAN 18, 1978
REF DES: MT2
TOTAL NUMBER OF ELECTRODE STRIPES: 301

SIZE	FSCM NO.	DRAWING NO.	REV
A	05869	1950520	
SCALE:	NONE	SHEET	14

STRIPE NO.	DIM X STRIPE LOCATION	DIM Y BREAK LOCATION	DIM S STRIPE WIDTH
51	-9.70028E-01	1.15474E 00	5.86081E 00
52	-9.58314E-01	-1.18364E 00	5.85277E 00
53	-9.46616E-01	1.21266E 00	5.84477E 00
54	-9.34935E-01	-1.24178E 00	5.83681E 00
55	-9.23269E-01	1.27100E 00	5.82887E 00
56	-9.11619E-01	-1.30029E 00	5.82097E 00
57	-8.99985E-01	1.32963E 00	5.81310E 00
58	-8.88367E-01	-1.35901E 00	5.80526E 00
59	-8.76764E-01	1.38842E 00	5.79745E 00
60	-8.65177E-01	-1.41781E 00	5.78967E 00
61	-8.53605E-01	1.44720E 00	5.78193E 00
62	-8.42049E-01	-1.47656E 00	5.77421E 00
63	-8.30509E-01	1.50588E 00	5.76653E 00
64	-8.18983E-01	-1.53512E 00	5.75888E 00
65	-8.07473E-01	1.56430E 00	5.75126E 00
66	-7.95978E-01	-1.59338E 00	5.74367E 00
67	-7.84498E-01	1.62234E 00	5.73611E 00
68	-7.73034E-01	-1.65119E 00	5.72858E 00
69	-7.61584E-01	1.67990E 00	5.72107E 00
70	-7.50149E-01	-1.70846E 00	5.71360E 00
71	-7.38729E-01	1.73684E 00	5.70616E 00
72	-7.27325E-01	-1.76503E 00	5.69874E 00
73	-7.15935E-01	1.79304E 00	5.69136E 00
74	-7.04559E-01	-1.82083E 00	5.68400E 00
75	-6.93198E-01	1.84838E 00	5.67667E 00
76	-6.81862E-01	-1.87571E 00	5.66937E 00
77	-6.70521E-01	1.90278E 00	5.66209E 00
78	-6.59204E-01	-1.92958E 00	5.65485E 00
79	-6.47902E-01	1.95611E 00	5.64764E 00
80	-6.36613E-01	-1.98233E 00	5.64045E 00
81	-6.25340E-01	2.00826E 00	5.63329E 00
82	-6.14080E-01	-2.03389E 00	5.62615E 00
83	-6.02835E-01	2.05918E 00	5.61905E 00
84	-5.91604E-01	-2.08413E 00	5.61196E 00
85	-5.80387E-01	2.10872E 00	5.60491E 00
86	-5.69184E-01	-2.13296E 00	5.59789E 00
87	-5.57996E-01	2.15683E 00	5.59088E 00
88	-5.46821E-01	-2.18032E 00	5.58391E 00
89	-5.35660E-01	2.20343E 00	5.57696E 00
90	-5.24513E-01	-2.22611E 00	5.57003E 00
91	-5.13380E-01	2.24839E 00	5.56314E 00
92	-5.02260E-01	-2.27025E 00	5.55627E 00
93	-4.91155E-01	2.29170E 00	5.54942E 00
94	-4.80063E-01	-2.31270E 00	5.54259E 00
95	-4.68984E-01	2.33325E 00	5.53580E 00
96	-4.57919E-01	-2.35334E 00	5.52903E 00
97	-4.46868E-01	2.37297E 00	5.52228E 00
98	-4.35830E-01	-2.39213E 00	5.51556E 00
99	-4.24806E-01	2.41083E 00	5.50887E 00
100	-4.13795E-01	-2.42902E 00	5.50219E 00

TRANSDUCER NAME: ECOMMT PCQ FAMMING APODIZED TRANSDUCER
DATE: JAN 18, 1978
REF DES: MT2
TOTAL NUMBER OF ELECTRODE STRIPES: 301

SIZE	FSCM NO.	DRAWING NO.	REV
A	05869	1950520	
SCALE:	NONE	SHEET	15

STRIPE NO.	DIM X STRIPE LOCATION	DIM Y BREAK LOCATION	DIM S STRIPE WIDTH
101	-4.02797E-01	2.44674E 00	5.49554E 00
102	-3.91813E-01	-2.46396E 00	5.48892E 00
103	-3.80841E-01	2.48067E 00	5.48232E 00
104	-3.69883E-01	-2.49687E 00	5.47574E 00
105	-3.58938E-01	2.51257E 00	5.46919E 00
106	-3.4800-E-01	-2.52774E 00	5.46266E 00
107	-3.37088E-01	2.54239E 00	5.45616E 00
108	-3.26182E-01	-2.55651E 00	5.44967E 00
109	-3.15289E-01	2.57010E 00	5.44321E 00
110	-3.04409E-01	-2.58315E 00	5.43677E 00
111	-2.93542E-01	2.59566E 00	5.43036E 00
112	-2.82687E-01	-2.60763E 00	5.42397E 00
113	-2.71846E-01	2.61905E 00	5.41760E 00
114	-2.61017E-01	-2.62992E 00	5.41125E 00
115	-2.50201E-01	2.64024E 00	5.40492E 00
116	-2.39397E-01	-2.65000E 00	5.39863E 00
117	-2.28606E-01	2.65921E 00	5.39234E 00
118	-2.17828E-01	-2.66785E 00	5.38608E 00
119	-2.07062E-01	2.67594E 00	5.37985E 00
120	-1.96308E-01	-2.68346E 00	5.37363E 00
121	-1.85567E-01	2.69043E 00	5.36744E 00
122	-1.74839E-01	-2.69683E 00	5.36127E 00
123	-1.64122E-01	2.70266E 00	5.35512E 00
124	-1.53418E-01	-2.70794E 00	5.34898E 00
125	-1.42726E-01	2.71264E 00	5.34287E 00
126	-1.32047E-01	-2.71679E 00	5.33679E 00
127	-1.21379E-01	2.72037E 00	5.33072E 00
128	-1.10724E-01	-2.72339E 00	5.32467E 00
129	-1.00080E-01	2.72585E 00	5.31864E 00
130	-8.94491E-02	-2.72775E 00	5.31264E 00
131	-7.88298E-02	2.72909E 00	5.30665E 00
132	-6.82225E-02	-2.72988E 00	5.30069E 00
133	-5.76270E-02	2.73011E 00	5.29474E 00
134	-4.70435E-02	-2.72979E 00	5.28882E 00
135	-3.64717E-02	2.72892E 00	5.28292E 00
136	-2.59118E-02	-2.72751E 00	5.27703E 00
137	-1.53636E-02	2.72555E 00	5.27116E 00
138	-4.82711E-03	-2.72305E 00	5.26531E 00
139	5.69770E-03	2.72002E 00	5.25949E 00
140	1.62109E-02	-2.71645E 00	5.25368E 00
141	2.67125E-02	2.71235E 00	5.24789E 00
142	3.72025E-02	-2.70773E 00	5.24212E 00
143	4.76810E-02	2.70258E 00	5.23638E 00
144	5.81480E-02	-2.69692E 00	5.23064E 00
145	6.86036E-02	2.69074E 00	5.22493E 00
146	7.90477E-02	-2.68405E 00	5.21924E 00
147	8.94805E-02	2.67687E 00	5.21356E 00
148	9.99020E-02	-2.66919E 00	5.20790E 00
149	1.10312E-01	2.66100E 00	5.20226E 00
150	1.20711E-01	-2.65234E 00	5.19664E 00

TRANSDUCER NAME: ECOMMT PCQ FAMMING APODIZED TRANSDUCER
DATE: JAN 18, 1978
REF DES: MT2
TOTAL NUMBER OF ELECTRODE STRIPES: 301

SIZE	FSCM NO.	DRAWING NO.	REV
A	05869	1950520	
SCALE:	NONE	SHEET	16

STRIPE NO.	DIM X STRIPE LOCATION	DIM Y BREAK LOCATION	DIM S STRIPE WIDTH
151	1.31099E-01	2.64319E 00	5.19104E 00
152	1.41475E-01	-2.63357E 00	5.18545E 00
153	1.51841E-01	2.62348E 00	5.17989E 00
154	1.62195E-01	-2.61292E 00	5.17434E 00
155	1.72538E-01	2.60191E 00	5.16881E 00
156	1.82870E-01	-2.59045E 00	5.16330E 00
157	1.93191E-01	2.57854E 00	5.15780E 00
158	2.03501E-01	-2.56619E 00	5.15233E 00
159	2.13801E-01	2.55342E 00	5.14686E 00
160	2.24089E-01	-2.54022E 00	5.14142E 00
161	2.34366E-01	2.52660E 00	5.13600E 00
162	2.44633E-01	-2.51257E 00	5.13059E 00
163	2.54889E-01	2.49815E 00	5.12519E 00
164	2.65134E-01	-2.48332E 00	5.11982E 00
165	2.75368E-01	2.46811E 00	5.11446E 00
166	2.85592E-01	-2.45252E 00	5.10912E 00
167	2.95805E-01	2.43656E 00	5.10380E 00
168	3.06007E-01	-2.42024E 00	5.09849E 00
169	3.16198E-01	2.40355E 00	5.09320E 00
170	3.26380E-01	-2.38652E 00	5.08792E 00
171	3.36550E-01	2.36915E 00	5.08267E 00
172	3.46710E-01	-2.35145E 00	5.07743E 00
173	3.56860E-01	2.33343E 00	5.07220E 00
174	3.66999E-01	-2.31509E 00	5.06699E 00
175	3.77128E-01	2.29644E 00	5.06179E 00
176	3.87246E-01	-2.27749E 00	5.05662E 00
177	3.97354E-01	2.25826E 00	5.05146E 00
178	4.07452E-01	-2.23874E 00	5.04631E 00
179	4.17540E-01	2.21896E 00	5.04118E 00
180	4.27617E-01	-2.19891E 00	5.03606E 00
181	4.37684E-01	2.17860E 00	5.03096E 00
182	4.47741E-01	-2.15805E 00	5.02588E 00
183	4.57787E-01	2.13726E 00	5.02081E 00
184	4.67824E-01	-2.11625E 00	5.01576E 00
185	4.77850E-01	2.09501E 00	5.01072E 00
186	4.87867E-01	-2.07356E 00	5.00570E 00
187	4.97873E-01	2.05191E 00	5.00069E 00
188	5.07870E-01	-2.03007E 00	4.99570E 00
189	5.17856E-01	2.00805E 00	4.99072E 00
190	5.27833E-01	-1.98585E 00	4.98576E 00
191	5.37799E-01	1.96348E 00	4.98081E 00
192	5.47756E-01	-1.94096E 00	4.97587E 00
193	5.57703E-01	1.91829E 00	4.97096E 00
194	5.67640E-01	-1.89548E 00	4.96605E 00
195	5.77567E-01	1.87255E 00	4.96116E 00
196	5.87484E-01	-1.84949E 00	4.95629E 00
197	5.97392E-01	1.82632E 00	4.95142E 00
198	6.07290E-01	-1.80305E 00	4.94658E 00
199	6.17178E-01	1.77968E 00	4.94174E 00
200	6.27057E-01	-1.75623E 00	4.93693E 00

TRANSDUCER NAME: ECOMMT PCQ FAMMING APODIZED TRANSDUCER

DATE: JAN 18, 1978	SIZE	FSCM NO.	DRAWING NO.	REV
REF DES: MT2	A	05869	1950520	
TOTAL NUMBER OF ELECTRODE STRIPES: 301	SCALE:	NONE	SHEET	17

STRIPE NO.	DIM X STRIPE LOCATION	DIM Y BREAK LOCATION	DIM S STRIPE WIDTH
201	6.36926E-01	1.73270E 00	4.93212E 00
202	6.46786E-01	-1.70910E 00	4.92733E 00
203	6.56636E-01	1.68545E 00	4.92255E 00
204	6.66476E-01	-1.66175E 00	4.91779E 00
205	6.76307E-01	1.63800E 00	4.91304E 00
206	6.86128E-01	-1.61423E 00	4.90831E 00
207	6.95940E-01	1.59043E 00	4.90359E 00
208	7.05742E-01	-1.56661E 00	4.89888E 00
209	7.15535E-01	1.54279E 00	4.89419E 00
210	7.25319E-01	-1.51897E 00	4.88950E 00
211	7.35094E-01	1.49517E 00	4.88484E 00
212	7.44859E-01	-1.47138E 00	4.88018E 00
213	7.54614E-01	1.44761E 00	4.87554E 00
214	7.64361E-01	-1.42389E 00	4.87091E 00
215	7.74098E-01	1.40020E 00	4.86630E 00
216	7.83826E-01	-1.37658E 00	4.86170E 00
217	7.93545E-01	1.35300E 00	4.85711E 00
218	8.03254E-01	-1.32950E 00	4.85253E 00
219	8.12955E-01	1.30607E 00	4.84797E 00
220	8.22646E-01	-1.28273E 00	4.84342E 00
221	8.32329E-01	1.25948E 00	4.83889E 00
222	8.42002E-01	-1.23632E 00	4.83436E 00
223	8.51666E-01	1.21328E 00	4.82985E 00
224	8.61321E-01	-1.19035E 00	4.82535E 00
225	8.70968E-01	1.16753E 00	4.82086E 00
226	8.80605E-01	-1.14485E 00	4.81639E 00
227	8.90233E-01	1.12231E 00	4.81193E 00
228	8.99853E-01	-1.09990E 00	4.80748E 00
229	9.09463E-01	1.07765E 00	4.80304E 00
230	9.19085E-01	-1.05555E 00	4.79862E 00
231	9.28658E-01	1.03362E 00	4.79421E 00
232	9.38242E-01	-1.01186E 00	4.78981E 00
233	9.47817E-01	9.90278E-01	4.78542E 00
234	9.57383E-01	-9.68876E-01	4.78104E 00
235	9.66941E-01	9.47665E-01	4.77668E 00
236	9.76490E-01	-9.26653E-01	4.77233E 00
237	9.86030E-01	9.05842E-01	4.76799E 00
238	9.95562E-01	-8.85238E-01	4.76366E 00
239	1.00508E 00	8.64851E-01	4.75934E 00
240	1.01460E 00	-8.44686E-01	4.75504E 00
241	1.02411E 00	8.24744E-01	4.75074E 00
242	1.03360E 00	-8.05036E-01	4.74646E 00
243	1.04308E 00	7.855658-01	4.74219E 00
244	1.05257E 00	-7.66338E-01	4.73794E 00
245	1.06204E 00	7.47357E-01	4.73369E 00
246	1.07151E 00	-7.28628E-01	4.72945E 00
247	1.08096E 00	7.10160E-01	4.72523E 00
248	1.09041E 00	-6.91955E-01	4.72101E 00
249	1.09984E 00	6.74019E-01	4.71681E 00
250	1.10927E 00	-6.56354E-01	4.71262E 00

TRANSDUCER NAME: ECOMMT PCQ FAMMING APODIZED TRANSDUCER
DATE: JAN 18, 1978
REF DES: MT2
TOTAL NUMBER OF ELECTRODE STRIPES: 301

SIZE	FSCM NO.	DRAWING NO.	REV
A	05869	1950520	
SCALE:	NONE	SHEET	18

STRIPE NO.	DIM X STRIPE LOCATION	DIM Y BREAK LOCATION	DIM S STRIPE WIDTH
251	1.11870E 00	6.38964E-01	4.70844E 00
252	1.12811E 00	-6.21858E-01	4.70427E 00
253	1.13751E 00	6.05039E-01	4.70012E 00
254	1.14691E 00	-5.88510E-01	4.69597E 00
255	1.15630E 00	5.72273E-01	4.69184E 00
256	1.16568E 00	-5.56336E-01	4.68771E 00
257	1.17505E 00	5.40699E-01	4.68360E 00
258	1.18441E 00	-5.25370E-01	4.67950E 00
259	1.19376E 00	5.10349E-01	4.67540E 00
260	1.20311E 00	-4.95640E-01	4.67132E 00
261	1.21245E 00	4.81248E-01	4.66725E 00
262	1.22178E 00	-4.67174E-01	4.66319E 00
263	1.23110E 00	4.53422E-01	4.65914E 00
264	1.24042E 00	-4.39994E-01	4.65510E 00
265	1.24972E 00	4.26894E-01	4.65108E 00
266	1.25902E 00	-4.14126E-01	4.64706E 00
267	1.26831E 00	4.01690E-01	4.64305E 00
268	1.27759E 00	-3.89589E-01	4.63905E 00
269	1.28687E 00	3.77826E-01	4.63507E 00
270	1.29613E 00	-3.66403E-01	4.63109E 00
271	1.30539E 00	3.55322E-01	4.62712E 00
272	1.31464E 00	-3.44583E-01	4.62317E 00
273	1.32388E 00	3.34191E-01	4.61922E 00
274	1.33312E 00	-3.24145E-01	4.61528E 00
275	1.34235E 00	3.14447E-01	4.61136E 00
276	1.35156E 00	-3.05100E-01	4.60744E 00
277	1.36078E 00	2.96103E-01	4.60354E 00
278	1.36998E 00	-2.87460E-01	4.59964E 00
279	1.37917E 00	2.79170E-01	4.59575E 00
280	1.38836E 00	-2.71235E-01	4.59188E 00
281	1.39754E 00	2.63654E-01	4.58801E 00
282	1.40671E 00	-2.56428E-01	4.58416E 00
283	1.41588E 00	2.49559E-01	4.58031E 00
284	1.42504E 00	-2.43047E-01	4.57647E 00
285	1.43418E 00	2.36892E-01	4.57264E 00
286	1.44333E 00	-2.31093E-01	4.56882E 00
287	1.45246E 00	2.25653E-01	4.56501E 00
288	1.46159E 00	-2.20569E-01	4.56122E 00
289	1.47070E 00	2.15842E-01	4.55743E 00
290	1.47982E 00	-2.11472E-01	4.55365E 00
291	1.48892E 00	2.07458E-01	4.54988E 00
292	1.49802E 00	-2.03800E-01	4.54611E 00
293	1.50710E 00	2.00498E-01	4.54236E 00
294	1.51618E 00	-1.97549E-01	4.53862E 00
295	1.52526E 00	1.94955E-01	4.53488E 00
296	1.53432E 00	-1.92713E-01	4.53116E 00
297	1.54338E 00	1.90822E-01	4.52745E 00
298	1.55243E 00	-1.89282E-01	4.52374E 00
299	1.56148E 00	1.88091E-01	4.52004E 00
300	1.57051E 00	-1.87248E-01	4.51635E 00

TRANSDUCER NAME: ECOMMT PCQ HAMMING APODIZED TRANSDUCER
DATE: JAN 18, 1978
REF DES: MT2
TOTAL NUMBER OF ELECTRODE STRIPES: 301

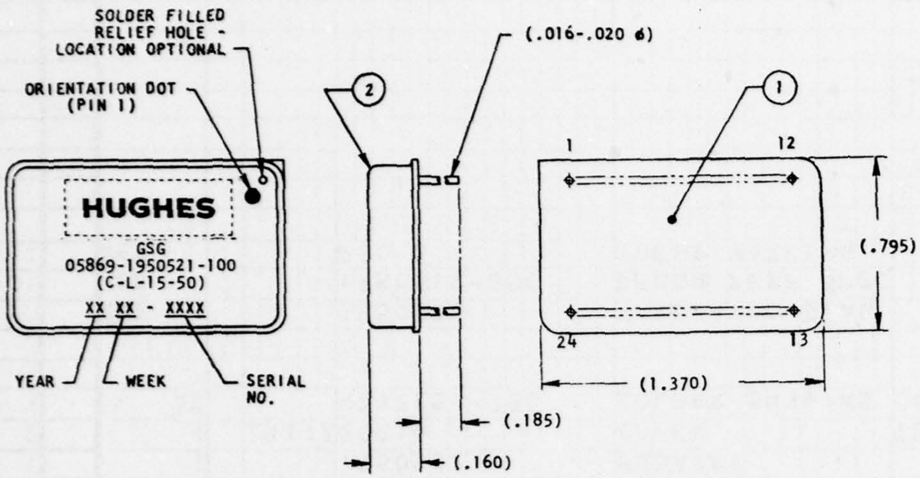
SIZE	FSCM NO.	DRAWING NO.	REV
A	05869	1950520	
SCALE:	NONE	SHEET	19

STRIPE NO.	DIM X STRIPE LOCATION	DIM Y BREAK LOCATION	DIM S STRIPE WIDTH
301	1.57954E 00	1.86752E-01	4.51267E 00

TRANSDUCER NAME: ECOMMT PCQ HAMMING APODIZED TRANSDUCER
DATE: JAN 18, 1978
REF DES: MT2
TOTAL NUMBER OF ELECTRODE STRIPES: 301

SIZE	FSCM NO.	DRAWING NO.	REV
A	05869	1950520	
SCALE:	NONE	SHEET	20

REVISIONS					
AUTHORITY	ZONE	LTR	DESCRIPTION	DATE	APPROVED
DDT 74356		-	PRODUCTION RELEASE	77-11-10	



NOTES - UNLESS OTHERWISE SPECIFIED

1. FOR SCHEMATIC DIAGRAM SEE 1950522.
2. THIS ITEM SHALL MEET THE REQUIREMENTS OF 1950512-600.
3. IDENTIFICATION MARKING PER P80-3.
4. SEAL ASSEMBLY USING ITEM 3 OR BY PROJECTION WELDING (MFG OPTION).

SEE SEPARATE PARTS LIST

-	SAW MMT
NEXT ASSY	USED ON
APPLICATION	

EXCEPT AS NOTED DIM. ARE IN INCHES AND PER ANS Y14.5
.XXX .XX ANGLES
±.010 ±.03 ±0°30'

MATERIAL

CONTRACT: DAAB07-75-C-0044
DR L. Y. Arakaki 77-10-28
CHK W. Burns 77-10-29
APPD 77-11-09

HUGHES — HUGHES AIRCRAFT COMPANY, FULLERTON, CALIFORNIA

DELAY LINE, SURFACE ACOUSTIC WAVE — CENTER FREQ 150 MHz, BANDWIDTH 50 MHz (PULSE COMPRESSION FILTER)

SIZE	CODE IDENT NO	DRAWING NO.	REV
B	05869	1950521-100	
SCALE NONE		SHEET	

11-063B-1 GS 7/73 12-66-42 FORM 3

PARTS LIST TRANSMITTAL

HUGHES AIRCRAFT COMPANY
FULLERTON, CALIFORNIA

ISSUE: | ACTION: A

10 CONTRACT: DAAB07-75-C-0044

PL 1950521-100 | CODE IDENT 05869 | 11 REV - | 77 09 23 (YR MO DAY)

12 LIST TITLE: DELAY LINE, SAW

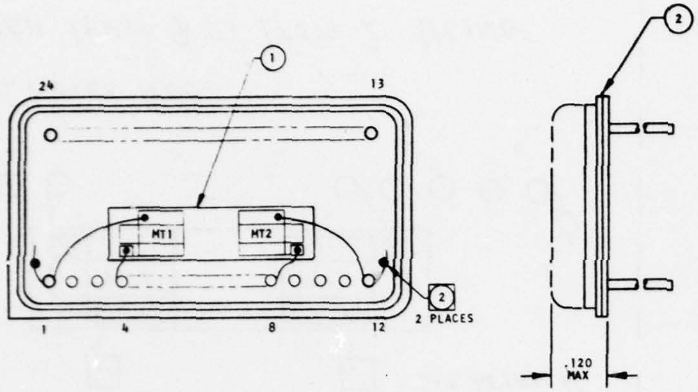
13 MAINT: | 14 PROJECT: SAW NMT | 15 REFERENCE NO.: | 16 REV AUTH:

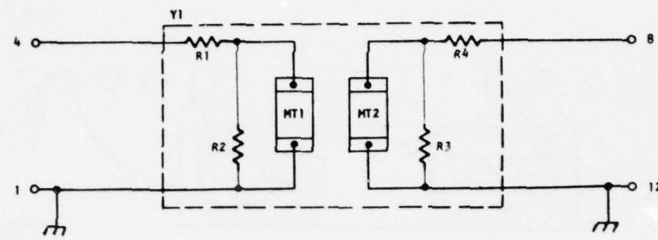
SHEET 1 OF 1

	ITEM NO.	LINE NO.	QUANTITY REQUIRED (20)	UNIT OF MEAS (21)	CODE IDENT (22)	PART OR IDENT NUMBER (23)	DESCRIPTION (24)	SPECIFICATION OR REFERENCE (25)	REF DESIGNATION FROM (26)	THRU (27)	AUTH (28)	WT (29)
A	1		1			1950522	SUBASSY					
A	2		1		29172	20216	COVER	TEKFORM				
A	3		AR			4277250-996	SOLDER, SN361W5	QQ-S-571				
A	1900		REF			1950522	SCHEMATIC DIAG					
A	1901		REF			1950512-600	DESGN PERF SPEC					
A	1902		REF			P80-3	IDENT MARKING					

H. Burns | DATE 77-09-23 | CHECKED BY: | DATE 77- | APPROVED BY: [signature] | DATE 77-11-09 | APPROVED BY: | 77-

AUTHORITY	LTR	DESCRIPTION	DATE	APPROVED
REVISIONS				
DDT 74356	-	PRODUCTION RELEASE	77-11-	





SCHEMATIC DIAGRAM

NOTES - UNLESS OTHERWISE SPECIFIED:

1. ATTACH ITEM 1 TO ITEM 2 USING ITEM 7.
2. SOLDER CONNECTION TO HEADER AS SHOWN USING ITEM 8.
3. ALL OTHER CONNECTIONS ARE WIRE BONDS PER MIL-STD-883, METHOD 2017 USING ITEM 6.

SEE SEPARATE PARTS LIST

1950521-100	SAW MMT
NEXT ASSY	USED ON
APPLICATION	

EXCEPT AS NOTED DIM ARE IN INCHES AND PER ANSI Y14.5 .XXX .XX ANGLES ±.010 ±.03 ±0.5°

MATERIAL

CONTRACT: DAAB07-75-C-0044

DR 77-11-08

CHK 77-11-09

APPD 77-11-09

HUGHES

HUGHES AIRCRAFT COMPANY FULLERTON, CALIFORNIA

DELAY LINE SUBASSEMBLY, SURFACE ACOUSTIC WAVE - CENTER FREQ 150 MHz, BANDWIDTH 50 MHz

SIZE	FSCM NO	DWG NO	REV
C	05869	1950522	
SCALE NONE		SHEET	

12-67-31 FORM 3

FORM NO. 110648-CS-GS REV. 7-76 DIETERICH-POST CLEARPRINT 1000H-10

DWG NO 1950522 SH REV

HUGHES

FSCM NO. 05869

☒ **ENGINEERING ORDER**
☐ **DOCUMENT CHANGE NOTICE**

☐ CLASS I ☒ CLASS II ☐ COMPATIBILITY CLASS II ☐ RECORD CORRECTION

CHANGE IDENT NO. 76420 | SHEET 1 OF 2

TITLE	PROJECT	ECP/UPN, ETC.	DRAWING NO.	REV.	NO.
DELAY LINE SUBASSEMBLY, SURFACE ACOUSTIC WAVE	SAW MMT		1950522	-	1

EFFECTIVITY: ☒ MANDATORY ☐ MANUFACTURING CONVENIENCE ☐ MANUFACTURING OPTION

	ORG CODE	DATE
PREPARED BY L. DYAL	12-67-80	78 01-12
CHECKED BY W. Voigt	12-66-42	78-01 13
PL MAINTENANCE		
APPROVED	12-67-80	78 01-12

CONTROL ITEM DRAWING NO.	FROM	THRU	CONFIGURATION ITEM DRAWING NO.	FROM	THRU
1950521-100	1	UP			

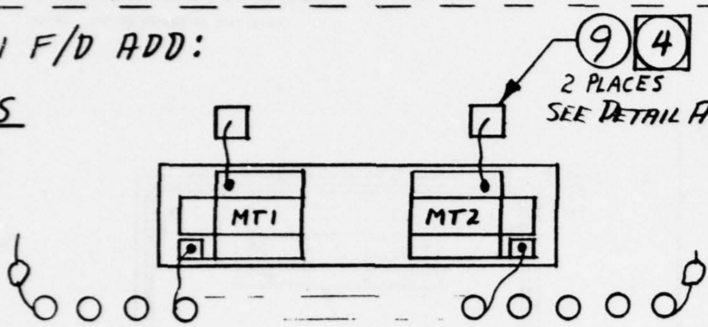
DISPOSITION OF ITEMS: ☐ ITEMS CONFORM ☐ USE ☐ REWORK AS FOLLOWS: SEE REWORK INSTRUCTIONS

REASON AND DESCRIPTION – SEE BELOW FOR P/L CHANGES

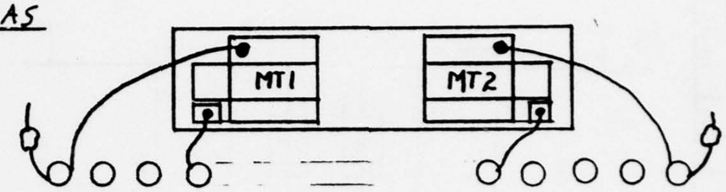
REASON: MODIFY GROUND INTERCONNECT TO MEET MIL STD 883.

ON F/D ADD:

IS



WAS



IN GENERAL NOTES ADD:

4. ATTACH ITEM 9 TO ITEM 2 USING ITEM 10

STANDARD
GSG
RELEASE
GSG

ITEM NO.	LINE NO.	ADD	DELETE	QTY REQ.	UNIT OF MEAS	MFG CODE IDENT NO.	PART OR IDENT NUMBER	DESCRIPTION	SPECIFICATION OR REFERENCE	FROM REF. DESIGNATION	THRU REF. DESIGNATION	WEIGHT IN LBS.	P/L NOTE	ZONE
9		AR		AR				.010 TH. KOVAR STOCK IRON NKL COBALT ALLOY ASTEM F15, CL1	MIL-I-23011					
10		AR		AR			760662	COND. ADHESIVE	ABLESTICK 36-2					

4775 GS 5/76

HUGHES

FSCM NO. 05869

☒ ENGINEERING ORDER

☐ DOCUMENT CHANGE NOTICE

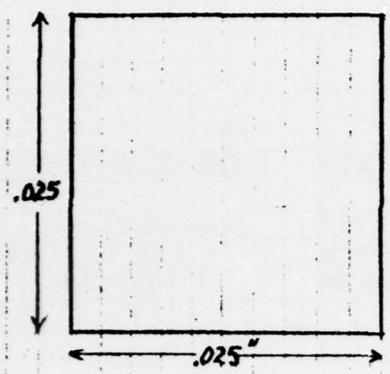
CONTINUATION SHEET

DRAWING NO.	REV.	NO.
1950522	-	1

CHANGE IDENT NO.	SHEET 2 OF 2
76420	

CONTROL ITEM EFFECTIVITY DRAWING NO.	FROM	THRU	CONFIGURATION ITEM EFFECTIVITY DRAWING NO.	FROM	THRU	CONTROL ITEM EFFECTIVITY DRAWING NO.	FROM	THRU	CONFIGURATION ITEM EFFECTIVITY DRAWING NO.	FROM	THRU
1950521-100	1	UP									

ON F/D ADD



KOVAR PATTERN

DETAIL A

ITEM NO.	LINE NO.	ADD	DELETE	QTY REQ.	UNIT OF MEAS.	MFG CODE IDENT. NO.	PART OR IDENT. NUMBER	DESCRIPTION	SPECIFICATION OR REFERENCE	FROM REF. DESIGNATION	THRU REF. DESIGNATION	WEIGHT IN LBS.	P/L NOTE	ZONE

4775-A GS 5/76

PARTS LIST TRANSMITTAL

HUGHES AIRCRAFT COMPANY
FULLERTON, CALIFORNIA

ISSUE: | ACTION: A

10 CONTRACT: DAAB07-75-C-0044

PL 1950522

CODE IDENT: 05869

11 DATE: 77 09 26 (YR MO DAY)

12 LIST TITLE: DELAY LINE SUBASSY, SAW

13 MAINT: | 14 PROJECT: MMT | 15 REFERENCE NO.: | 16 REV AUTH:

SHEET 1 OF 1

	ITEM NO.	LINE NO.	QUANTITY REQUIRED (20)	UNIT OF MEAS (21)	CODE IDENT (22)	PART OR IDENT NUMBER (23)	DESCRIPTION (24)	SPECIFICATION OR REFERENCE (25)	REF DESIGNATION FROM (26)	THRU (27)	AUTH (28)	WTLR (29)	PL NOTE (30)
A	1		1			1950523	CRYSTAL		Y1				
A	2		1		29172	20221	HEADER	TEKFORM					
N	3												
N	4												
N	5												
A	6		AR			760660-11	WIRE, GOLD .001						
A	7		AR		71984	3140 RTV	ADHESIVE	DOW CORNING					
A	8		AR			4277250-999	SOLDER, SN63	QQ-S-571					
A	4900		REF			MIL-STD-883	WIRE BOND SPEC						

PREPARED BY	DATE	CHECKED BY	DATE	APPROVED BY	DATE	APPROVED BY	DATE
K. Burns	77-09-26		77- -	[signature]	77-11-09		77- -

13-319 GS 12 70

1950523

REVISIONS				
AUTHORITY	LTR	DESCRIPTION	DATE	APPROVED
DDT 86948		PRODUCTION RELEASE	78-08-29	

NOTES:

1. MATERIAL: LITHIUM NIOBATE PER 760716
2. FABRICATE PER 780294
3. DEPOSITION THICKNESS:
   0.20 ±0.01 μm
   (20.00 ±100 Å)
4. INDICATES DIRECTION OF SPECIFIED CRYSTALLINE AXIS & PROPAGATION DIRECTION.
5. HORIZONTAL CENTERLINES OF MT1 & MT2 SHALL BE CO-LINEAR WITHIN AND PARALLEL TO Z-AXIS WITHIN 0.25°.
6. IN DIMENSIONAL LISTINGS, THE NO. FOLLOWING THE LETTER E INDICATES THE POWER OF 10 BY WHICH THE NO. MUST BE MULTIPLIED TO OBTAIN THE CORRECT VALUE. FOR EXAMPLE:

   $1.45870E-02 = 1.45870 \times 10^{-2} = 0.014587$

   $1.34567E\ 00 = 1.34567 \times 10^{0} = 1.34567$
7. DEPOSITION FILM APPLIED IN INDICATED AREA.
8. INDICATED SURFACE TO BE CORRUGATED PER P82.
9. BACK SURFACE TO BE ROUGHENED WITH #180 GRIT.

FRAGILE ITEM (EASILY DAMAGED BY HANDLING) - TO BE INSTALLED IN NEXT ASSEMBLY AT POINT OF MANUFACTURE.

METRIC

THIRD ANGLE (AMERICAN) PROJECTION

1950522	SAW-MMT
NEXT ASSY	USED ON
APPLICATION	

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN MILLIMETERS & PER ANSI Y14.5

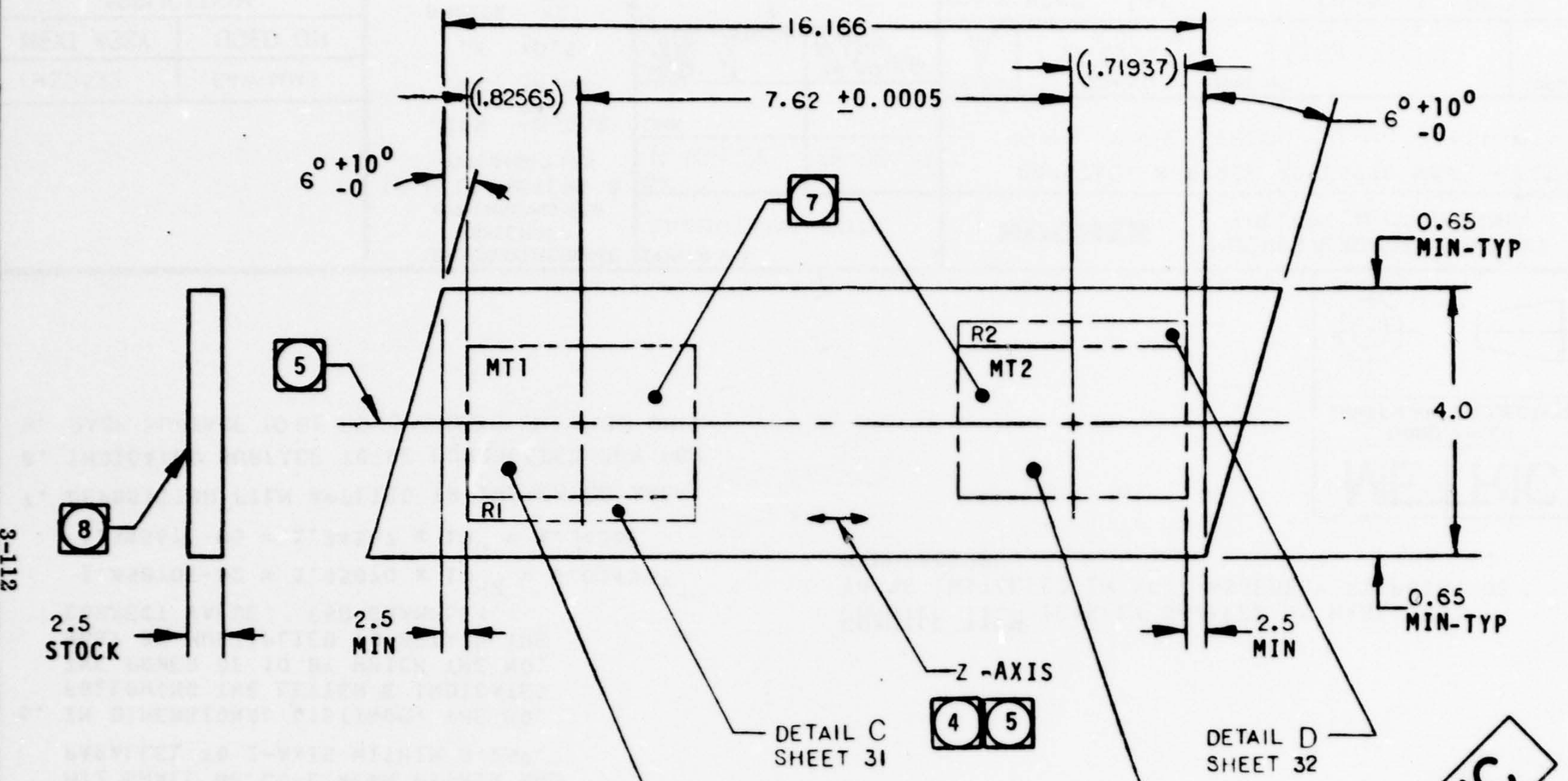
.XXX	±0.002
.XX	±0.02
.X	±0.5
ANGLES	±2°

CONTRACT: DAAB07-75C-0074	
DR K. KELLY	78-08-25
CHK	
APP	78-09-06

HUGHES — HUGHES AIRCRAFT COMPANY, FULLERTON, CALIFORNIA

CRYSTAL, SURFACE ACOUSTIC WAVE - PCLN
150 MH_Z CENTER FREQ., 50 MH_Z BANDWIDTH

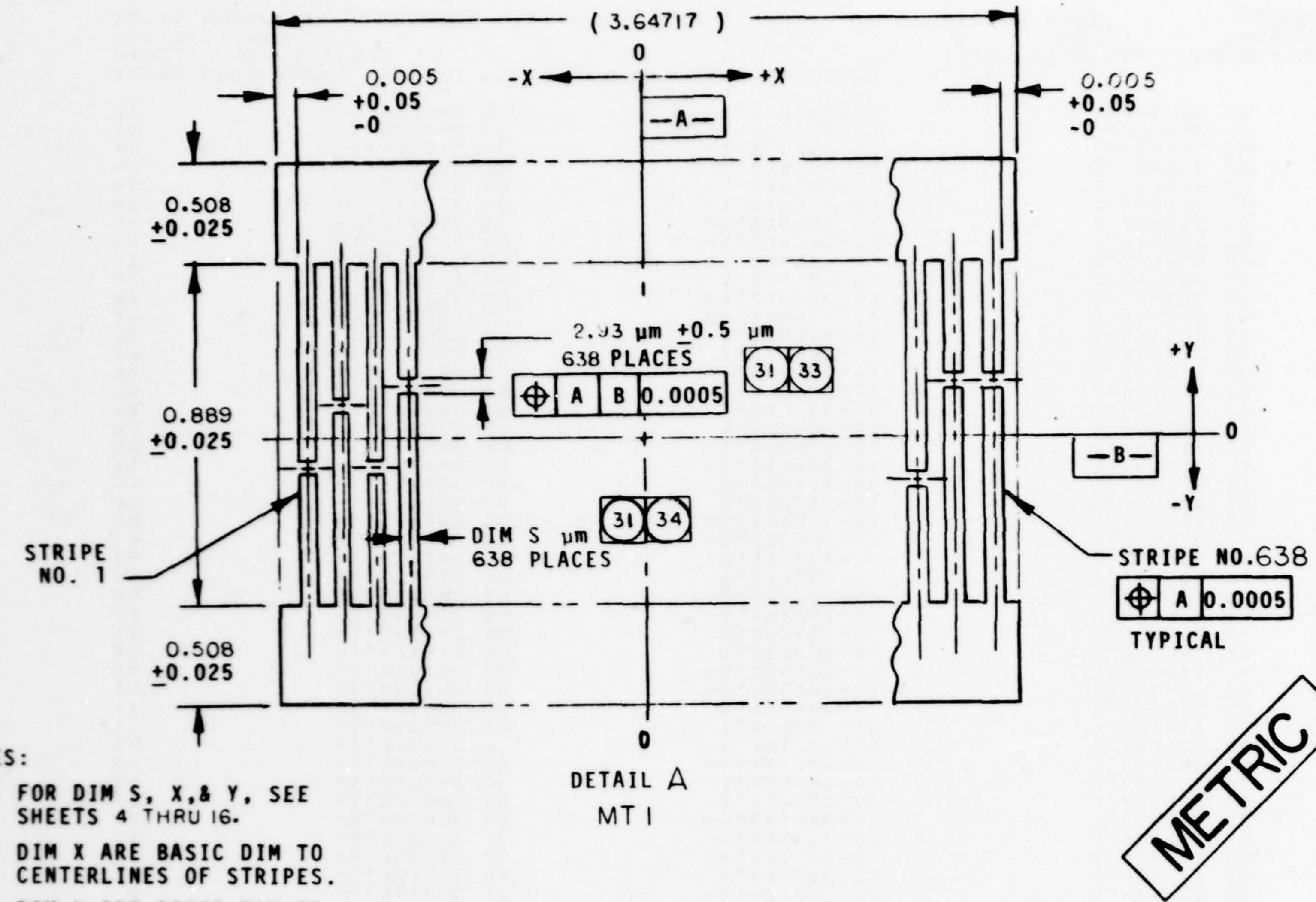
SIZE	FSCM NO.	DWG NO.	REV
A	05869	1950523	
SCALE NONE	WT	SHEET 1 OF 32	



21 MT2 IS ROTATED 180° SO THAT STRIPE NO. 602 IS CLOSEST TO STRIPE NO. 638 OF MT1.

METRIC

HUGHES AIRCRAFT COMPANY FULLERTON, CALIFORNIA	CONTRACT: DAAB07-75C-0074			
DR K. KELLY	SIZE A	FSCM NO. 05869	DWG NO. 1950523	REV
ISSUED	SCALE NONE		SHEET 2	



NOTES:

31. FOR DIM S, X, & Y, SEE SHEETS 4 THRU 16.
32. DIM X ARE BASIC DIM TO CENTERLINES OF STRIPES.
33. DIM Y ARE BASIC DIM TO CENTERLINES OF STRIPE BREAKS.
34. TOLERANCE: ±0.1 µm PER µm.

HUGHES AIRCRAFT COMPANY FULLERTON, CALIFORNIA	CONTRACT: DAAB07-75C-0074		
DR K. KELLY	SIZE A	FSCM NO. 05869	DWG NO. 1950523	REV
ISSUED	SCALE NONE		SHEET 3

STRIPE NO.	DIM X STRIPE LOCATION	DIM Y BREAK LOCATION	DIM S STRIPE WIDTH
1	-1.80842E 00	8.36757E-07	3.44648E 00
2	-1.80153E 00	8.36757E-07	3.44648E 00
3	-1.79464E 00	-6.66238E-05	3.44087E 00
4	-1.78776E 00	-6.66238E-05	3.44087E 00
5	-1.78088E 00	4.97471E-04	3.43529E 00
6	-1.77401E 00	4.97471E-04	3.43529E 00
7	-1.76715E 00	-1.82189E-03	3.42973E 00
8	-1.76029E 00	-1.82189E-03	3.42973E 00
9	-1.75343E 00	4.67315E-03	3.42421E 00
10	-1.74658E 00	4.67315E-03	3.42421E 00
11	-1.73974E 00	-9.64442E-03	3.41870E 00
12	-1.73290E 00	-9.64442E-03	3.41870E 00
13	-1.72607E 00	1.71352E-02	3.41323E 00
14	-1.71924E 00	1.71352E-02	3.41323E 00
15	-1.71242E 00	-2.72172E-02	3.40778E 00
16	-1.70561E 00	-2.72172E-02	3.40778E 00
17	-1.69880E 00	3.95904E-02	3.40236E 00
18	-1.69199E 00	3.95904E-02	3.40236E 00
19	-1.68519E 00	-5.35579E-02	3.39696E 00
20	-1.67840E 00	-5.35579E-02	3.39696E 00
21	-1.67161E 00	6.80789E-02	3.39159E 00
22	-1.66483E 00	6.80789E-02	3.39159E 00
23	-1.65805E 00	-8.19122E-02	3.38625E 00
24	-1.65128E 00	-8.19122E-02	3.38625E 00
25	-1.64451E 00	9.37756E-02	3.38093E 00
26	-1.63775E 00	9.37756E-02	3.38093E 00
27	-1.63099E 00	-1.02505E-01	3.37563E 00
28	-1.62424E 00	-1.02505E-01	3.37563E 00
29	-1.61750E 00	1.07211E-01	3.37036E 00
30	-1.61075E 00	1.07211E-01	3.37036E 00
31	-1.60402E 00	-1.07898E-01	3.36512E 00
32	-1.59729E 00	-1.07898E-01	3.36512E 00
33	-1.59056E 00	1.07898E-01	3.35990E 00
34	-1.58384E 00	1.07898E-01	3.35990E 00
35	-1.57713E 00	-1.07898E-01	3.35470E 00
36	-1.57042E 00	-1.07898E-01	3.35470E 00
37	-1.56372E 00	1.07898E-01	3.34953E 00
38	-1.55702E 00	1.07898E-01	3.34953E 00
39	-1.55032E 00	-1.07898E-01	3.34438E 00
40	-1.54363E 00	-1.07898E-01	3.34438E 00
41	-1.53695E 00	1.07898E-01	3.33925E 00
42	-1.53027E 00	1.07898E-01	3.33925E 00
43	-1.52360E 00	-1.07898E-01	3.33415E 00
44	-1.51693E 00	-1.07898E-01	3.33415E 00
45	-1.51027E 00	1.07898E-01	3.32907E 00
46	-1.50361E 00	1.07898E-01	3.32907E 00
47	-1.49696E 00	-1.07898E-01	3.32402E 00
48	-1.49031E 00	-1.07898E-01	3.32402E 00
49	-1.48366E 00	1.07898E-01	3.31898E 00
50	-1.47703E 00	1.07898E-01	3.31898E 00

TRANSDUCER NAME: ECOMMT PCLN, UNAPODIZED TRANSDUCER
DATE: JAN 18,1978
REF DES: MT1
TOTAL NUMBER OF ELECTRODE STRIPES: 638

SIZE	FSCM NO.	DRAWING NO.	REV
A	05869	1950523	
SCALE: NONE		SHEET	4

STRIPE NO.	DIM X STRIPE LOCATION	DIM Y BREAK LOCATION	DIM S STRIPE WIDTH
51	-1.47039E 00	-1.07898E-01	3.31397E 00
52	-1.46377E 00	-1.07898E-01	3.31397E 00
53	-1.45714E 00	1.07898E-01	3.30899E 00
54	-1.45053E 00	1.07898E-01	3.30899E 00
55	-1.44391E 00	-1.07898E-01	3.30402E 00
56	-1.43730E 00	-1.07898E-01	3.30402E 00
57	-1.43070E 00	1.07898E-01	3.29908E 00
58	-1.42410E 00	1.07898E-01	3.29908E 00
59	-1.41751E 00	-1.07898E-01	3.29416E 00
60	-1.41092E 00	-1.07898E-01	3.29416E 00
61	-1.40434E 00	1.07898E-01	3.28926E 00
62	-1.39776E 00	1.07898E-01	3.28926E 00
63	-1.39119E 00	-1.07898E-01	3.28438E 00
64	-1.38462E 00	-1.07898E-01	3.28438E 00
65	-1.37805E 00	1.07898E-01	3.27953E 00
66	-1.37149E 00	1.07898E-01	3.27953E 00
67	-1.36494E 00	-1.07898E-01	3.27469E 00
68	-1.35839E 00	-1.07898E-01	3.27469E 00
69	-1.35185E 00	1.07898E-01	3.26988E 00
70	-1.34531E 00	1.07898E-01	3.26988E 00
71	-1.33877E 00	-1.07898E-01	3.26509E 00
72	-1.33224E 00	-1.07898E-01	3.26509E 00
73	-1.32572E 00	1.07898E-01	3.26032E 00
74	-1.31919E 00	1.07898E-01	3.26032E 00
75	-1.31268E 00	-1.07898E-01	3.25557E 00
76	-1.30617E 00	-1.07898E-01	3.25557E 00
77	-1.29966E 00	1.07898E-01	3.25084E 00
78	-1.29316E 00	1.07898E-01	3.25084E 00
79	-1.28666E 00	-1.07898E-01	3.24614E 00
80	-1.28017E 00	-1.07898E-01	3.24614E 00
81	-1.27368E 00	1.07898E-01	3.24145E 00
82	-1.26720E 00	1.07898E-01	3.24145E 00
83	-1.26072E 00	-1.07898E-01	3.23678E 00
84	-1.25425E 00	-1.07898E-01	3.23678E 00
85	-1.24778E 00	1.07898E-01	3.23213E 00
86	-1.24131E 00	1.07898E-01	3.23213E 00
87	-1.23485E 00	-1.07898E-01	3.22751E 00
88	-1.22840E 00	-1.07898E-01	3.22751E 00
89	-1.22195E 00	1.07898E-01	3.22290E 00
90	-1.21550E 00	1.07898E-01	3.22290E 00
91	-1.20906E 00	-1.07898E-01	3.21831E 00
92	-1.20263E 00	-1.07898E-01	3.21831E 00
93	-1.19619E 00	1.07898E-01	3.21374E 00
94	-1.18977E 00	1.07898E-01	3.21374E 00
95	-1.18334E 00	-1.07898E-01	3.20919E 00
96	-1.17692E 00	-1.07898E-01	3.20919E 00
97	-1.17051E 00	1.07898E-01	3.20467E 00
98	-1.16410E 00	1.07898E-01	3.20467E 00
99	-1.15770E 00	-1.07898E-01	3.20015E 00
100	-1.15130E 00	-1.07898E-01	3.20015E 00

TRANSDUCER NAME: ECOMMT PCLN, UNAPODIZED TRANSDUCER
DATE: JAN 18,1978
REF DES: MT1
TOTAL NUMBER OF ELECTRODE STRIPES: 638

SIZE FSCM NO. DRAWING NO. REV.
A 05869 1950523
SCALE: NONE SHEET 5

STRIPE NO.	DIM X STRIPE LOCATION	DIM Y BREAK LOCATION	DIM S STRIPE WIDTH
101	-1.14490E 00	1.07898E-01	3.19566E 00
102	-1.13851E 00	1.07898E-01	3.19566E 00
103	-1.13212E 00	-1.07898E-01	3.19119E 00
104	-1.12574E 00	-1.07898E-01	3.19119E 00
105	-1.11936E 00	1.07898E-01	3.18674E 00
106	-1.11299E 00	1.07898E-01	3.18674E 00
107	-1.10662E 00	-1.07898E-01	3.18230E 00
108	-1.10026E 00	-1.07898E-01	3.18230E 00
109	-1.09389E 00	1.07898E-01	3.17789E 00
110	-1.08754E 00	1.07898E-01	3.17789E 00
111	-1.08119E 00	-1.07898E-01	3.17349E 00
112	-1.07484E 00	-1.07898E-01	3.17349E 00
113	-1.06850E 00	1.07898E-01	3.16911E 00
114	-1.06216E 00	1.07898E-01	3.16911E 00
115	-1.05583E 00	-1.07898E-01	3.16475E 00
116	-1.04950E 00	-1.07898E-01	3.16475E 00
117	-1.04317E 00	1.07898E-01	3.16040E 00
118	-1.03685E 00	1.07898E-01	3.16040E 00
119	-1.03053E 00	-1.07898E-01	3.15607E 00
120	-1.02422E 00	-1.07898E-01	3.15607E 00
121	-1.01791E 00	1.07898E-01	3.15177E 00
122	-1.01161E 00	1.07898E-01	3.15177E 00
123	-1.00531E 00	-1.07898E-01	3.14747E 00
124	-9.99017E-01	-1.07898E-01	3.14747E 00
125	-9.92727E-01	1.07898E-01	3.14320E 00
126	-9.86440E-01	1.07898E-01	3.14320E 00
127	-9.80158E-01	-1.07898E-01	3.13895E 00
128	-9.73880E-01	-1.07898E-01	3.13895E 00
129	-9.67606E-01	1.07898E-01	3.13471E 00
130	-9.61337E-01	1.07898E-01	3.13471E 00
131	-9.55072E-01	-1.07898E-01	3.13048E 00
132	-9.48811E-01	-1.07898E-01	3.13048E 00
133	-9.42554E-01	1.07898E-01	3.12628E 00
134	-9.36302E-01	1.07898E-01	3.12628E 00
135	-9.30053E-01	-1.07898E-01	3.12209E 00
136	-9.23809E-01	-1.07898E-01	3.12209E 00
137	-9.17569E-01	1.07898E-01	3.11792E 00
138	-9.11333E-01	1.07898E-01	3.11792E 00
139	-9.05101E-01	-1.07898E-01	3.11377E 00
140	-8.98874E-01	-1.07898E-01	3.11377E 00
141	-8.92651E-01	1.07898E-01	3.10963E 00
142	-8.86431E-01	1.07898E-01	3.10963E 00
143	-8.80216E-01	-1.07898E-01	3.10551E 00
144	-8.74005E-01	-1.07898E-01	3.10551E 00
145	-8.67798E-01	1.07898E-01	3.10140E 00
146	-8.61595E-01	1.07898E-01	3.10140E 00
147	-8.55397E-01	-1.07898E-01	3.09731E 00
148	-8.49202E-01	-1.07898E-01	3.09731E 00
149	-8.43011E-01	1.07898E-01	3.09324E 00
150	-8.36825E-01	1.07898E-01	3.09324E 00

TRANSDUCER NAME: ECOMMT PCLN, UNAPODIZED TRANSDUCER
DATE: JAN 18,1978
REF DES: MT1
TOTAL NUMBER OF ELECTRODE STRIPES: 638

SIZE	FSCM NO.	DRAWING NO.	REV
A	05869	1950523	
SCALE: NONE		SHEET	6

STRIPE NO.	DIM X STRIPE LOCATION	DIM Y BREAK LOCATION	DIM S STRIPE WIDTH
151	-8.30643E-01	-1.07898E-01	3.08918E 00
152	-8.24464E-01	-1.07898E-01	3.08918E 00
153	-8.18290E-01	1.07898E-01	3.08514E 00
154	-8.12120E-01	1.07898E-01	3.08514E 00
155	-8.05953E-01	-1.07898E-01	3.08112E 00
156	-7.99791E-01	-1.07898E-01	3.08112E 00
157	-7.93633E-01	1.07898E-01	3.07711E 00
158	-7.87479E-01	1.07898E-01	3.07711E 00
159	-7.81328E-01	-1.07898E-01	3.07312E 00
160	-7.75182E-01	-1.07898E-01	3.07312E 00
161	-7.69040E-01	1.07898E-01	3.06914E 00
162	-7.62902E-01	1.07898E-01	3.06914E 00
163	-7.56767E-01	-1.07898E-01	3.06518E 00
164	-7.50637E-01	-1.07898E-01	3.06518E 00
165	-7.44511E-01	1.07898E-01	3.06123E 00
166	-7.38388E-01	1.07898E-01	3.06123E 00
167	-7.32270E-01	-1.07898E-01	3.05729E 00
168	-7.26155E-01	-1.07898E-01	3.05729E 00
169	-7.20044E-01	1.07898E-01	3.05338E 00
170	-7.13938E-01	1.07898E-01	3.05338E 00
171	-7.07835E-01	-1.07898E-01	3.04947E 00
172	-7.01736E-01	-1.07898E-01	3.04947E 00
173	-6.95641E-01	1.07898E-01	3.04559E 00
174	-6.89550E-01	1.07898E-01	3.04559E 00
175	-6.83462E-01	-1.07898E-01	3.04172E 00
176	-6.77379E-01	-1.07898E-01	3.04172E 00
177	-6.71299E-01	1.07898E-01	3.03786E 00
178	-6.65224E-01	1.07898E-01	3.03786E 00
179	-6.59152E-01	-1.07898E-01	3.03402E 00
180	-6.53084E-01	-1.07898E-01	3.03402E 00
181	-6.47019E-01	1.07898E-01	3.03019E 00
182	-6.40959E-01	1.07898E-01	3.03019E 00
183	-6.34903E-01	-1.07898E-01	3.02637E 00
184	-6.28850E-01	-1.07898E-01	3.02637E 00
185	-6.22801E-01	1.07898E-01	3.02257E 00
186	-6.16756E-01	1.07898E-01	3.02257E 00
187	-6.10714E-01	-1.07898E-01	3.01879E 00
188	-6.04677E-01	-1.07898E-01	3.01879E 00
189	-5.98643E-01	1.07898E-01	3.01502E 00
190	-5.92613E-01	1.07898E-01	3.01502E 00
191	-5.86587E-01	-1.07898E-01	3.01126E 00
192	-5.80564E-01	-1.07898E-01	3.01126E 00
193	-5.74545E-01	1.07898E-01	3.00752E 00
194	-5.68530E-01	1.07898E-01	3.00752E 00
195	-5.62519E-01	-1.07898E-01	3.00379E 00
196	-5.56511E-01	-1.07898E-01	3.00379E 00
197	-5.50508E-01	1.07898E-01	3.00007E 00
198	-5.44507E-01	1.07898E-01	3.00007E 00
199	-5.38511E-01	-1.07898E-01	2.99637E 00
200	-5.32518E-01	-1.07898E-01	2.99637E 00

TRANSDUCER NAME: ECOMMT PCLN, UNAFODIZED TRANSDUCER
DATE: JAN 18,1978
REF DES: MT1
TOTAL NUMBER OF ELECTRODE STRIPES: 638

SIZE	FSCM NO.	DRAWING NO.	REV
A	05869	1950523	
SCALE: NONE		SHEET	7

STRIPE NO.	DIM X STRIPE LOCATION	DIM Y BREAK LOCATION	DIM S STRIPE WIDTH
201	-5.26529E-01	1.07898E-01	2.99268E 00
202	-5.20544E-01	1.07898E-01	2.99268E 00
203	-5.14562E-01	-1.07898E-01	2.98901E 00
204	-5.08584E-01	-1.07898E-01	2.98901E 00
205	-5.02610E-01	1.07898E-01	2.98535E 00
206	-4.96639E-01	1.07898E-01	2.98535E 00
207	-4.90672E-01	-1.07898E-01	2.98170E 00
208	-4.84709E-01	-1.07898E-01	2.98170E 00
209	-4.78749E-01	1.07898E-01	2.97807E 00
210	-4.72793E-01	1.07898E-01	2.97807E 00
211	-4.66840E-01	-1.07898E-01	2.97445E 00
212	-4.60891E-01	-1.07898E-01	2.97445E 00
213	-4.54946E-01	1.07898E-01	2.97084E 00
214	-4.49004E-01	1.07898E-01	2.97084E 00
215	-4.43066E-01	-1.07898E-01	2.96724E 00
216	-4.37132E-01	-1.07898E-01	2.96724E 00
217	-4.31201E-01	1.07898E-01	2.96366E 00
218	-4.25273E-01	1.07898E-01	2.96366E 00
219	-4.19350E-01	-1.07898E-01	2.96009E 00
220	-4.13429E-01	-1.07898E-01	2.96009E 00
221	-4.07513E-01	1.07898E-01	2.95654E 00
222	-4.01600E-01	1.07898E-01	2.95654E 00
223	-3.95690E-01	-1.07898E-01	2.95300E 00
224	-3.89784E-01	-1.07898E-01	2.95300E 00
225	-3.83882E-01	1.07898E-01	2.94947E 00
226	-3.77983E-01	1.07898E-01	2.94947E 00
227	-3.72087E-01	-1.07898E-01	2.94595E 00
228	-3.66196E-01	-1.07898E-01	2.94595E 00
229	-3.60307E-01	1.07898E-01	2.94244E 00
230	-3.54422E-01	1.07898E-01	2.94244E 00
231	-3.48541E-01	-1.07898E-01	2.93895E 00
232	-3.42663E-01	-1.07898E-01	2.93895E 00
233	-3.36789E-01	1.07898E-01	2.93547E 00
234	-3.30918E-01	1.07898E-01	2.93547E 00
235	-3.25050E-01	-1.07898E-01	2.93200E 00
236	-3.19186E-01	-1.07898E-01	2.93200E 00
237	-3.13326E-01	1.07898E-01	2.92855E 00
238	-3.07468E-01	1.07898E-01	2.92855E 00
239	-3.01615E-01	-1.07898E-01	2.92510E 00
240	-2.95765E-01	-1.07898E-01	2.92510E 00
241	-2.89918E-01	1.07898E-01	2.92167E 00
242	-2.84074E-01	1.07898E-01	2.92167E 00
243	-2.78235E-01	-1.07898E-01	2.91825E 00
244	-2.72398E-01	-1.07898E-01	2.91825E 00
245	-2.66565E-01	1.07898E-01	2.91485E 00
246	-2.60735E-01	1.07898E-01	2.91485E 00
247	-2.54909E-01	-1.07898E-01	2.91145E 00
248	-2.49086E-01	-1.07898E-01	2.91145E 00
249	-2.43267E-01	1.07898E-01	2.90807E 00
250	-2.37450E-01	1.07898E-01	2.90807E 00

TRANSDUCER NAME: ECOMMT PCLK, UNAPODIZED TRANSDUCER
DATE: JAN 18,1978
REF DES: MT1
TOTAL NUMBER OF ELECTRODE STRIPES: 638

SIZE	FSCM NO.	DRAWING NO.	REV
A	05869	1950523	
SCALE: NONE		SHEET	8

STRIPE NO.	DIM X STRIPE LOCATION	DIM Y BREAK LOCATION	DIM S STRIPE WIDTH
251	-2.31638E-01	-1.07898E-01	2.90470E 00
252	-2.25828E-01	-1.07898E-01	2.90470E 00
253	-2.20022E-01	1.07898E-01	2.90134E 00
254	-2.14220E-01	1.07898E-01	2.90134E 00
255	-2.08420E-01	-1.07898E-01	2.89799E 00
256	-2.02624E-01	-1.07898E-01	2.89799E 00
257	-1.96832E-01	1.07898E-01	2.89465E 00
258	-1.91042E-01	1.07898E-01	2.89465E 00
259	-1.85256E-01	-1.07898E-01	2.89133E 00
260	-1.79474E-01	-1.07898E-01	2.89133E 00
261	-1.73694E-01	1.07898E-01	2.88801E 00
262	-1.67918E-01	1.07898E-01	2.88801E 00
263	-1.62145E-01	-1.07898E-01	2.88471E 00
264	-1.56376E-01	-1.07898E-01	2.88471E 00
265	-1.50610E-01	1.07898E-01	2.88142E 00
266	-1.44847E-01	1.07898E-01	2.88142E 00
267	-1.39088E-01	-1.07898E-01	2.87814E 00
268	-1.33331E-01	-1.07898E-01	2.87814E 00
269	-1.27578E-01	1.07898E-01	2.87487E 00
270	-1.21829E-01	1.07898E-01	2.87487E 00
271	-1.16082E-01	-1.07898E-01	2.87161E 00
272	-1.10339E-01	-1.07898E-01	2.87161E 00
273	-1.04599E-01	1.07898E-01	2.86837E 00
274	-9.88621E-02	1.07898E-01	2.86837E 00
275	-9.31286E-02	-1.07898E-01	2.86513E 00
276	-8.73984E-02	-1.07898E-01	2.86513E 00
277	-8.16713E-02	1.07898E-01	2.86191E 00
278	-7.59475E-02	1.07898E-01	2.86191E 00
279	-7.02269E-02	-1.07898E-01	2.85869E 00
280	-6.45095E-02	-1.07898E-01	2.85869E 00
281	-5.87954E-02	1.07898E-01	2.85549E 00
282	-5.30844E-02	1.07898E-01	2.85549E 00
283	-4.73766E-02	-1.07898E-01	2.85230E 00
284	-4.16720E-02	-1.07898E-01	2.85230E 00
285	-3.59706E-02	1.07898E-01	2.84912E 00
286	-3.02724E-02	1.07898E-01	2.84912E 00
287	-2.45773E-02	-1.07898E-01	2.84594E 00
288	-1.88854E-02	-1.07898E-01	2.84594E 00
289	-1.31967E-02	1.07898E-01	2.84278E 00
290	-7.51111E-03	1.07898E-01	2.84278E 00
291	-1.82869E-03	-1.07898E-01	2.83964E 00
292	3.85059E-03	-1.07898E-01	2.83964E 00
293	9.52672E-03	1.07898E-01	2.83650E 00
294	1.51997E-02	1.07898E-01	2.83650E 00
295	2.08696E-02	-1.07898E-01	2.83337E 00
296	2.65363E-02	-1.07898E-01	2.83337E 00
297	3.21999E-02	1.07898E-01	2.83025E 00
298	3.78604E-02	1.07898E-01	2.83025E 00
299	4.35178E-02	-1.07898E-01	2.82714E 00
300	4.91721E-02	-1.07898E-01	2.82714E 00

TRANSDUCER NAME: ECOMMT PCLN, UNAPODIZED TRANSDUCER
DATE: JAN 18,1978
REF DES: MT1
TOTAL NUMBER OF ELECTRODE STRIPES: 638

SIZE	FSCM NO.	DRAWING NO.	REV
A	05869	1950523	
SCALE: NONE		SHEET	9

STRIPE NO.	DIM X STRIPE LOCATION	DIM Y BREAK LOCATION	DIM S STRIPE WIDTH
301	5.48233E-02	1.07898E-01	2.82404E 00
302	6.04714E-02	1.07898E-01	2.82404E 00
303	6.61163E-02	-1.07898E-01	2.82095E 00
304	7.17582E-02	-1.07898E-01	2.82095E 00
305	7.73970E-02	1.07898E-01	2.81788E 00
306	8.30328E-02	1.07898E-01	2.81788E 00
307	8.86655E-02	-1.07898E-01	2.81481E 00
308	9.42951E-02	-1.07898E-01	2.81481E 00
309	9.99217E-02	1.07898E-01	2.81175E 00
310	1.05545E-01	1.07898E-01	2.81175E 00
311	1.11166E-01	-1.07898E-01	2.80870E 00
312	1.16783E-01	-1.07898E-01	2.80870E 00
313	1.22397E-01	1.07898E-01	2.80566E 00
314	1.28009E-01	1.07898E-01	2.80566E 00
315	1.33617E-01	-1.07898E-01	2.80264E 00
316	1.39222E-01	-1.07898E-01	2.80264E 00
317	1.44825E-01	1.07898E-01	2.79962E 00
318	1.50424E-01	1.07898E-01	2.79962E 00
319	1.56020E-01	-1.07898E-01	2.79661E 00
320	1.61613E-01	-1.07898E-01	2.79661E 00
321	1.67203E-01	1.07898E-01	2.79361E 00
322	1.72791E-01	1.07898E-01	2.79361E 00
323	1.78375E-01	-1.07898E-01	2.79062E 00
324	1.83956E-01	-1.07898E-01	2.79062E 00
325	1.89534E-01	1.07898E-01	2.78764E 00
326	1.95110E-01	1.07898E-01	2.78764E 00
327	2.00682E-01	-1.07898E-01	2.78467E 00
328	2.06251E-01	-1.07898E-01	2.78467E 00
329	2.11818E-01	1.07898E-01	2.78171E 00
330	2.17381E-01	1.07898E-01	2.78171E 00
331	2.22942E-01	-1.07898E-01	2.77876E 00
332	2.28499E-01	-1.07898E-01	2.77876E 00
333	2.34054E-01	1.07898E-01	2.77582E 00
334	2.39605E-01	1.07898E-01	2.77582E 00
335	2.45154E-01	-1.07898E-01	2.77288E 00
336	2.50700E-01	-1.07898E-01	2.77288E 00
337	2.56243E-01	1.07898E-01	2.76996E 00
338	2.61783E-01	1.07898E-01	2.76996E 00
339	2.67320E-01	-1.07898E-01	2.76705E 00
340	2.72854E-01	-1.07898E-01	2.76705E 00
341	2.78385E-01	1.07898E-01	2.76414E 00
342	2.83913E-01	1.07898E-01	2.76414E 00
343	2.89439E-01	-1.07898E-01	2.76124E 00
344	2.94961E-01	-1.07898E-01	2.76124E 00
345	3.00481E-01	1.07898E-01	2.75836E 00
346	3.05997E-01	1.07898E-01	2.75836E 00
347	3.11511E-01	-1.07898E-01	2.75548E 00
348	3.17022E-01	-1.07898E-01	2.75548E 00
349	3.22530E-01	1.07898E-01	2.75261E 00
350	3.28035E-01	1.07898E-01	2.75261E 00

TRANSDUCER NAME: ECOMMT PCLN, UNAPODIZED TRANSDUCER
DATE: JAN 18,1978
REF DES: MT1
TOTAL NUMBER OF ELECTRODE STRIPES: 638

SIZE	FSCM NO.	DRAWING NO.	REV
A	05869	1950523	
SCALE: NONE		SHEET	10

STRIPE NO.	DIM X STRIPE LOCATION	DIM Y BREAK LOCATION	DIM S STRIPE WIDTH
351	3.33538E-01	-1.07898E-01	2.74975E 00
352	3.39037E-01	-1.07898E-01	2.74975E 00
353	3.44534E-01	1.07898E-01	2.74690E 00
354	3.50028E-01	1.07898E-01	2.74690E 00
355	3.55519E-01	-1.07898E-01	2.74406E 00
356	3.61007E-01	-1.07898E-01	2.74406E 00
357	3.66492E-01	1.07898E-01	2.74123E 00
358	3.71975E-01	1.07898E-01	2.74123E 00
359	3.77454E-01	-1.07898E-01	2.73840E 00
360	3.82931E-01	-1.07898E-01	2.73840E 00
361	3.88405E-01	1.07898E-01	2.73558E 00
362	3.93876E-01	1.07898E-01	2.73558E 00
363	3.99345E-01	-1.07898E-01	2.73278E 00
364	4.04810E-01	-1.07898E-01	2.73278E 00
365	4.10273E-01	1.07898E-01	2.72998E 00
366	4.15733E-01	1.07898E-01	2.72998E 00
367	4.21190E-01	-1.07898E-01	2.72719E 00
368	4.26644E-01	-1.07898E-01	2.72719E 00
369	4.32096E-01	1.07898E-01	2.72441E 00
370	4.37545E-01	1.07898E-01	2.72441E 00
371	4.42991E-01	-1.07898E-01	2.72163E 00
372	4.48434E-01	-1.07898E-01	2.72163E 00
373	4.53875E-01	1.07898E-01	2.71887E 00
374	4.59312E-01	1.07898E-01	2.71887E 00
375	4.64747E-01	-1.07898E-01	2.71611E 00
376	4.70180E-01	-1.07898E-01	2.71611E 00
377	4.75609E-01	1.07898E-01	2.71337E 00
378	4.81036E-01	1.07898E-01	2.71337E 00
379	4.86460E-01	-1.07898E-01	2.71063E 00
380	4.91881E-01	-1.07898E-01	2.71063E 00
381	4.97300E-01	1.07898E-01	2.70790E 00
382	5.02715E-01	1.07898E-01	2.70790E 00
383	5.08128E-01	-1.07898E-01	2.70517E 00
384	5.13539E-01	-1.07898E-01	2.70517E 00
385	5.18946E-01	1.07898E-01	2.70246E 00
386	5.24351E-01	1.07898E-01	2.70246E 00
387	5.29754E-01	-1.07898E-01	2.69975E 00
388	5.35153E-01	-1.07898E-01	2.69975E 00
389	5.40550E-01	1.07898E-01	2.69705E 00
390	5.45944E-01	1.07898E-01	2.69705E 00
391	5.51335E-01	-1.07898E-01	2.69436E 00
392	5.56724E-01	-1.07898E-01	2.69436E 00
393	5.62110E-01	1.07898E-01	2.69168E 00
394	5.67493E-01	1.07898E-01	2.69168E 00
395	5.72874E-01	-1.07898E-01	2.68901E 00
396	5.78252E-01	-1.07898E-01	2.68901E 00
397	5.83628E-01	1.07898E-01	2.68634E 00
398	5.89000E-01	1.07898E-01	2.68634E 00
399	5.94370E-01	-1.07898E-01	2.68368E 00
400	5.99738E-01	-1.07898E-01	2.68368E 00

TRANSDUCER NAME: ECOMMT PCLN, UNAPODIZED TRANSDUCER
DATE: JAN 18,1978
REF DES: MT1
TOTAL NUMBER OF ELECTRODE STRIPES: 638

SIZE	FSCM NO.	DRAWING NO.	REV
A	05869	1950523	
SCALE: NONE		SHEET	11

STRIPE NO.	DIM X STRIPE LOCATION	DIM Y BREAK LOCATION	DIM S STRIPE WIDTH
401	6.05102E-01	1.07898E-01	2.68103E 00
402	6.10464E-01	1.07898E-01	2.68103E 00
403	6.15824E-01	-1.07898E-01	2.67839E 00
404	6.21181E-01	-1.07898E-01	2.67839E 00
405	6.26535E-01	1.07898E-01	2.67575E 00
406	6.31886E-01	1.07898E-01	2.67575E 00
407	6.37235E-01	-1.07898E-01	2.67313E 00
408	6.42581E-01	-1.07898E-01	2.67313E 00
409	6.47925E-01	1.07898E-01	2.67051E 00
410	6.53266E-01	1.07898E-01	2.67051E 00
411	6.58605E-01	-1.07898E-01	2.66790E 00
412	6.63940E-01	-1.07898E-01	2.66790E 00
413	6.69273E-01	1.07898E-01	2.66529E 00
414	6.74604E-01	1.07898E-01	2.66529E 00
415	6.79932E-01	-1.07898E-01	2.66269E 00
416	6.85257E-01	-1.07898E-01	2.66269E 00
417	6.90580E-01	1.07898E-01	2.66011E 00
418	6.95900E-01	1.07898E-01	2.66011E 00
419	7.01218E-01	-1.07898E-01	2.65753E 00
420	7.06533E-01	-1.07898E-01	2.65753E 00
421	7.11846E-01	1.07898E-01	2.65495E 00
422	7.17156E-01	1.07898E-01	2.65495E 00
423	7.22463E-01	-1.07898E-01	2.65238E 00
424	7.27768E-01	-1.07898E-01	2.65238E 00
425	7.33070E-01	1.07898E-01	2.64983E 00
426	7.38369E-01	1.07898E-01	2.64983E 00
427	7.43667E-01	-1.07898E-01	2.64727E 00
428	7.48961E-01	-1.07898E-01	2.64727E 00
429	7.54253E-01	1.07898E-01	2.64473E 00
430	7.59543E-01	1.07898E-01	2.64473E 00
431	7.64830E-01	-1.07898E-01	2.64219E 00
432	7.70114E-01	-1.07898E-01	2.64219E 00
433	7.75396E-01	1.07898E-01	2.63966E 00
434	7.80675E-01	1.07898E-01	2.63966E 00
435	7.85952E-01	-1.07898E-01	2.63714E 00
436	7.91226E-01	-1.07898E-01	2.63714E 00
437	7.96498E-01	1.07898E-01	2.63463E 00
438	8.01767E-01	1.07898E-01	2.63463E 00
439	8.07034E-01	-1.07898E-01	2.63212E 00
440	8.12298E-01	-1.07898E-01	2.63212E 00
441	8.17560E-01	1.07898E-01	2.62962E 00
442	8.22819E-01	1.07898E-01	2.62962E 00
443	8.28076E-01	-1.07898E-01	2.62712E 00
444	8.33330E-01	-1.07898E-01	2.62712E 00
445	8.38582E-01	1.07898E-01	2.62464E 00
446	8.43831E-01	1.07898E-01	2.62464E 00
447	8.49078E-01	-1.07898E-01	2.62216E 00
448	8.54322E-01	-1.07898E-01	2.62216E 00
449	8.59564E-01	1.07898E-01	2.61968E 00
450	8.64804E-01	1.07898E-01	2.61968E 00

TRANSDUCER NAME: ECOMMT PCLN, UNAPODIZED TRANSDUCER
DATE: JAN 18,1978
REF DES: MT1
TOTAL NUMBER OF ELECTRODE STRIPES: 638

SIZE	FSCM NO.	DRAWING NO.	REV
A	05869	1950523	
SCALE: NONE		SHEET	12

STRIPE NO.	DIM X STRIPE LOCATION	DIM Y BREAK LOCATION	DIM S STRIPE WIDTH
451	8.70040E-01	-1.07898E-01	2.61722E 00
452	8.75275E-01	-1.07898E-01	2.61722E 00
453	8.80507E-01	1.07898E-01	2.61476E 00
454	8.85736E-01	1.07898E-01	2.61476E 00
455	8.90963E-01	-1.07898E-01	2.61231E 00
456	8.96188E-01	-1.07898E-01	2.61231E 00
457	9.01410E-01	1.07898E-01	2.60986E 00
458	9.06630E-01	1.07898E-01	2.60986E 00
459	9.11847E-01	-1.07898E-01	2.60743E 00
460	9.17062E-01	-1.07898E-01	2.60743E 00
461	9.22275E-01	1.07898E-01	2.60499E 00
462	9.27485E-01	1.07898E-01	2.60499E 00
463	9.32692E-01	-1.07898E-01	2.60257E 00
464	9.37897E-01	-1.07898E-01	2.60257E 00
465	9.43100E-01	1.07898E-01	2.60015E 00
466	9.48300E-01	1.07898E-01	2.60015E 00
467	9.53498E-01	-1.07898E-01	2.59774E 00
468	9.58694E-01	-1.07898E-01	2.59774E 00
469	9.63887E-01	1.07898E-01	2.59534E 00
470	9.69077E-01	1.07898E-01	2.59534E 00
471	9.74266E-01	-1.07898E-01	2.59294E 00
472	9.79452E-01	-1.07898E-01	2.59294E 00
473	9.84635E-01	1.07898E-01	2.59055E 00
474	9.89816E-01	1.07898E-01	2.59055E 00
475	9.94995E-01	-1.07898E-01	2.58817E 00
476	1.00017E 00	-1.07898E-01	2.58817E 00
477	1.00534E 00	1.07898E-01	2.58579E 00
478	1.01052E 00	1.07898E-01	2.58579E 00
479	1.01569E 00	-1.07898E-01	2.58342E 00
480	1.02085E 00	-1.07898E-01	2.58342E 00
481	1.02602E 00	1.07898E-01	2.58105E 00
482	1.03118E 00	1.07898E-01	2.58105E 00
483	1.03634E 00	-1.07898E-01	2.57869E 00
484	1.04150E 00	-1.07898E-01	2.57869E 00
485	1.04665E 00	1.07898E-01	2.57634E 00
486	1.05180E 00	1.07898E-01	2.57634E 00
487	1.05695E 00	-1.07898E-01	2.57400E 00
488	1.06210E 00	-1.07898E-01	2.57400E 00
489	1.06725E 00	1.07898E-01	2.57166E 00
490	1.07239E 00	1.07898E-01	2.57166E 00
491	1.07753E 00	-1.07898E-01	2.56932E 00
492	1.08267E 00	-1.07898E-01	2.56932E 00
493	1.08781E 00	1.07898E-01	2.56700E 00
494	1.09294E 00	1.07898E-01	2.56700E 00
495	1.09807E 00	-1.07898E-01	2.56468E 00
496	1.10320E 00	-1.07898E-01	2.56468E 00
497	1.10833E 00	1.07898E-01	2.56236E 00
498	1.11345E 00	1.07898E-01	2.56236E 00
499	1.11858E 00	-1.07898E-01	2.56006E 00
500	1.12370E 00	-1.07898E-01	2.56006E 00

TRANSDUCER NAME: ECOMMT PCLN, UNAPODIZED TRANSDUCER
DATE: JAN 18,1978
REF DES: MT1
TOTAL NUMBER OF ELECTRODE STRIPES: 638

SIZE	FSCM NO.	DRAWING NO.	REV
A	05869	1950523	
SCALE: NONE		SHEET	13

STRIPE NO.	DIM X STRIPE LOCATION	DIM Y BREAK LOCATION	DIM S STRIPE WIDTH
501	1.12881E 00	1.07898E-01	2.55776E 00
502	1.13393E 00	1.07898E-01	2.55776E 00
503	1.13904E 00	-1.07898E-01	2.55546E 00
504	1.14415E 00	-1.07898E-01	2.55546E 00
505	1.14926E 00	1.07898E-01	2.55317E 00
506	1.15437E 00	1.07898E-01	2.55317E 00
507	1.15947E 00	-1.07898E-01	2.55089E 00
508	1.16457E 00	-1.07898E-01	2.55089E 00
509	1.16967E 00	1.07898E-01	2.54861E 00
510	1.17477E 00	1.07898E-01	2.54861E 00
511	1.17987E 00	-1.07898E-01	2.54634E 00
512	1.18496E 00	-1.07898E-01	2.54634E 00
513	1.19005E 00	1.07898E-01	2.54408E 00
514	1.19514E 00	1.07898E-01	2.54408E 00
515	1.20022E 00	-1.07898E-01	2.54182E 00
516	1.20531E 00	-1.07898E-01	2.54182E 00
517	1.21039E 00	1.07898E-01	2.53957E 00
518	1.21547E 00	1.07898E-01	2.53957E 00
519	1.22054E 00	-1.07898E-01	2.53732E 00
520	1.22562E 00	-1.07898E-01	2.53732E 00
521	1.23069E 00	1.07898E-01	2.53508E 00
522	1.23576E 00	1.07898E-01	2.53508E 00
523	1.24083E 00	-1.07898E-01	2.53285E 00
524	1.24590E 00	-1.07898E-01	2.53285E 00
525	1.25096E 00	1.07898E-01	2.53062E 00
526	1.25602E 00	1.07898E-01	2.53062E 00
527	1.26108E 00	-1.07898E-01	2.52840E 00
528	1.26614E 00	-1.07898E-01	2.52840E 00
529	1.27119E 00	1.07898E-01	2.52618E 00
530	1.27624E 00	1.07898E-01	2.52618E 00
531	1.28129E 00	-1.07898E-01	2.52397E 00
532	1.28634E 00	-1.07898E-01	2.52397E 00
533	1.29139E 00	1.07898E-01	2.52176E 00
534	1.29643E 00	1.07898E-01	2.52176E 00
535	1.30147E 00	-1.07898E-01	2.51956E 00
536	1.30651E 00	-1.07898E-01	2.51956E 00
537	1.31155E 00	1.07898E-01	2.51737E 00
538	1.31658E 00	1.07898E-01	2.51737E 00
539	1.32162E 00	-1.07898E-01	2.51518E 00
540	1.32664E 00	-1.07898E-01	2.51518E 00
541	1.33167E 00	1.07898E-01	2.51300E 00
542	1.33670E 00	1.07898E-01	2.51300E 00
543	1.34172E 00	-1.07898E-01	2.51082E 00
544	1.34674E 00	-1.07898E-01	2.51082E 00
545	1.35176E 00	1.07898E-01	2.50865E 00
546	1.35678E 00	1.07898E-01	2.50865E 00
547	1.36180E 00	-1.07898E-01	2.50648E 00
548	1.36681E 00	-1.07898E-01	2.50648E 00
549	1.37182E 00	1.07898E-01	2.50433E 00
550	1.37683E 00	1.07898E-01	2.50433E 00

TRANSDUCER NAME: ECOMMT PCLN, UNAPODIZED TRANSDUCER
DATE: JAN 18,1978
REF DES: MT1
TOTAL NUMBER OF ELECTRODE STRIPES: 638

SIZE	FSCM NO.	DRAWING NO.	REV
A	05869	1950523	
SCALE: NONE		SHEET	14

STRIPE NO.	DIM X STRIPE LOCATION	DIM Y BREAK LOCATION	DIM S STRIPE WIDTH
551	1.38184E 00	-1.07898E-01	2.50217E 00
552	1.38684E 00	-1.07898E-01	2.50217E 00
553	1.39184E 00	1.07898E-01	2.50002E 00
554	1.39684E 00	1.07898E-01	2.50002E 00
555	1.40184E 00	-1.07898E-01	2.49788E 00
556	1.40684E 00	-1.07898E-01	2.49788E 00
557	1.41183E 00	1.07898E-01	2.49574E 00
558	1.41682E 00	1.07898E-01	2.49574E 00
559	1.42181E 00	-1.07898E-01	2.49361E 00
560	1.42680E 00	-1.07898E-01	2.49361E 00
561	1.43178E 00	1.07898E-01	2.49148E 00
562	1.43677E 00	1.07898E-01	2.49148E 00
563	1.44175E 00	-1.07898E-01	2.48936E 00
564	1.44672E 00	-1.07898E-01	2.48936E 00
565	1.45170E 00	1.07898E-01	2.48725E 00
566	1.45668E 00	1.07898E-01	2.48725E 00
567	1.46165E 00	-1.07898E-01	2.48514E 00
568	1.46662E 00	-1.07898E-01	2.48514E 00
569	1.47159E 00	1.07898E-01	2.48303E 00
570	1.47655E 00	1.07898E-01	2.48303E 00
571	1.48152E 00	-1.07898E-01	2.48093E 00
572	1.48648E 00	-1.07898E-01	2.48093E 00
573	1.49144E 00	1.07898E-01	2.47884E 00
574	1.49640E 00	1.07898E-01	2.47884E 00
575	1.50135E 00	-1.07898E-01	2.47675E 00
576	1.50631E 00	-1.07898E-01	2.47675E 00
577	1.51126E 00	1.07898E-01	2.47466E 00
578	1.51621E 00	1.07898E-01	2.47466E 00
579	1.52115E 00	-1.07898E-01	2.47258E 00
580	1.52610E 00	-1.07898E-01	2.47258E 00
581	1.53104E 00	1.07898E-01	2.47051E 00
582	1.53598E 00	1.07898E-01	2.47051E 00
583	1.54092E 00	-1.07898E-01	2.46844E 00
584	1.54586E 00	-1.07898E-01	2.46844E 00
585	1.55079E 00	1.07898E-01	2.46638E 00
586	1.55573E 00	1.07898E-01	2.46638E 00
587	1.56066E 00	-1.07898E-01	2.46432E 00
588	1.56559E 00	-1.07898E-01	2.46432E 00
589	1.57051E 00	1.07898E-01	2.46227E 00
590	1.57544E 00	1.07898E-01	2.46227E 00
591	1.58036E 00	-1.07898E-01	2.46022E 00
592	1.58528E 00	-1.07898E-01	2.46022E 00
593	1.59020E 00	1.07898E-01	2.45818E 00
594	1.59511E 00	1.07898E-01	2.45818E 00
595	1.60003E 00	-1.07898E-01	2.45614E 00
596	1.60494E 00	-1.07898E-01	2.45614E 00
597	1.60985E 00	1.07507E-01	2.45411E 00
598	1.61476E 00	1.07507E-01	2.45411E 00
599	1.61967E 00	-1.04943E-01	2.45208E 00
600	1.62457E 00	-1.04943E-01	2.45208E 00

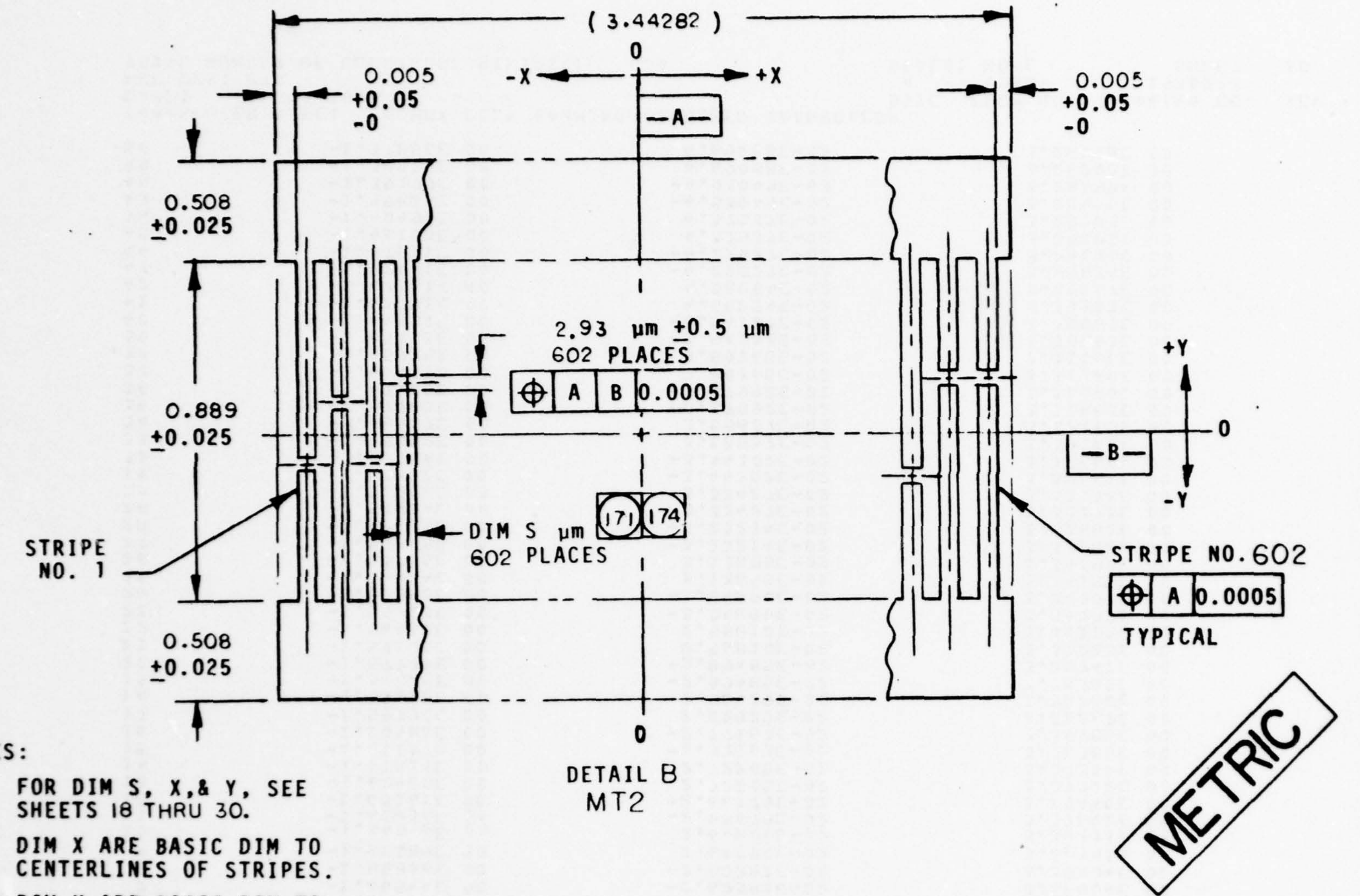
TRANSDUCER NAME: ECOMMT PCLN, UNAPODIZED TRANSDUCER
DATE: JAN 18,1978
REF DES: MT1
TOTAL NUMBER OF ELECTRODE STRIPES: 638

SIZE	FSCM NO.	DRAWING NO.	REV
A	05869	1950523	
SCALE: NONE		SHEET	15

STRIPE NO.	DIM X STRIPE LOCATION	DIM Y BREAK LOCATION	DIM S STRIPE WIDTH
601	1.62947E 00	1.00122E-01	2.45006E 00
602	1.63437E 00	1.00122E-01	2.45006E 00
603	1.63927E 00	-9.33171E-02	2.44804E 00
604	1.64417E 00	-9.33171E-02	2.44804E 00
605	1.64906E 00	8.48995E-02	2.44603E 00
606	1.65395E 00	8.48995E-02	2.44603E 00
607	1.65884E 00	-7.53151E-02	2.44402E 00
608	1.66373E 00	-7.53151E-02	2.44402E 00
609	1.66862E 00	6.50474E-02	2.44202E 00
610	1.67350E 00	6.50474E-02	2.44202E 00
611	1.67838E 00	-5.45880E-02	2.44002E 00
612	1.68326E 00	-5.45880E-02	2.44002E 00
613	1.68814E 00	4.43969E-02	2.43803E 00
614	1.69302E 00	4.43969E-02	2.43803E 00
615	1.69789E 00	-3.48777E-02	2.43604E 00
616	1.70276E 00	-3.48777E-02	2.43604E 00
617	1.70763E 00	2.63497E-02	2.43406E 00
618	1.71250E 00	2.63497E-02	2.43406E 00
619	1.71737E 00	-1.90327E-02	2.43208E 00
620	1.72223E 00	-1.90327E-02	2.43208E 00
621	1.72709E 00	1.30400E-02	2.43011E 00
622	1.73195E 00	1.30400E-02	2.43011E 00
623	1.73681E 00	-8.38161E-03	2.42814E 00
624	1.74167E 00	-8.38161E-03	2.42814E 00
625	1.74652E 00	4.97498E-03	2.42617E 00
626	1.75138E 00	4.97498E-03	2.42617E 00
627	1.75623E 00	-2.66250E-03	2.42422E 00
628	1.76107E 00	-2.66250E-03	2.42422E 00
629	1.76592E 00	1.23612E-03	2.42226E 00
630	1.77077E 00	1.23612E-03	2.42226E 00
631	1.77561E 00	-4.65166E-04	2.42031E 00
632	1.78045E 00	-4.65166E-04	2.42031E 00
633	1.78529E 00	1.23566E-04	2.41837E 00
634	1.79012E 00	1.23566E-04	2.41837E 00
635	1.79496E 00	-1.62263E-05	2.41643E 00
636	1.79979E 00	-1.62263E-05	2.41643E 00
637	1.80462E 00	2.01514E-07	2.41449E 00
638	1.80945E 00	2.01514E-07	2.41449E 00

TRANSDUCER NAME: ECOMMT PCLN, UNAFCDIZED TRANSDUCER
DATE: JAN 18,1978
REF DES: MT1
TOTAL NUMBER OF ELECTRODE STRIPES: 638

SIZE	FSCM NO.	DRAWING NO.	REV
A	05869	1950523	
SCALE: NONE		SHEET	16



DETAIL B
MT2

NOTES:

171 FOR DIM S, X, & Y, SEE SHEETS 18 THRU 30.

172. DIM X ARE BASIC DIM TO CENTERLINES OF STRIPES.

173 DIM Y ARE BASIC DIM TO CENTERLINES OF STRIPE BREAKS.

174 TOLERANCE: ±0.1 μm PER μm.

HUGHES AIRCRAFT COMPANY FULLERTON, CALIFORNIA	CONTRACT: DAAB07-75C-0074			
DR K. KELLY	SIZE A	FSCM NO. 05869	DWG NO. 1950523	REV
ISSUED	SCALE NONE		SHEET 17	

STRIPE NO.	DIM X STRIPE LOCATION	DIM Y BREAK LOCATION	DIM S STRIPE WIDTH
1	-1.70622E 00	2.60556E-02	3.40518E 00
2	-1.69941E 00	2.60556E-02	3.40518E 00
3	-1.69261E 00	-2.60250E-02	3.39978E 00
4	-1.68581E 00	-2.60250E-02	3.39978E 00
5	-1.67901E 00	2.60867E-02	3.39435E 00
6	-1.67223E 00	2.60867E-02	3.39435E 00
7	-1.66544E 00	-2.62391E-02	3.38904E 00
8	-1.65866E 00	-2.62391E-02	3.38904E 00
9	-1.65189E 00	2.64800E-02	3.38371E 00
10	-1.64512E 00	2.64800E-02	3.38371E 00
11	-1.63836E 00	-2.68079E-02	3.37840E 00
12	-1.63161E 00	-2.68079E-02	3.37840E 00
13	-1.62485E 00	2.72205E-02	3.37312E 00
14	-1.61811E 00	2.72205E-02	3.37312E 00
15	-1.61137E 00	-2.77163E-02	3.36786E 00
16	-1.60463E 00	-2.77163E-02	3.36786E 00
17	-1.59790E 00	2.82929E-02	3.36262E 00
18	-1.59118E 00	2.82929E-02	3.36262E 00
19	-1.58445E 00	-2.89485E-02	3.35742E 00
20	-1.57774E 00	-2.89485E-02	3.35742E 00
21	-1.57103E 00	2.96810E-02	3.35223E 00
22	-1.56433E 00	2.96810E-02	3.35223E 00
23	-1.55763E 00	-3.04890E-02	3.34707E 00
24	-1.55093E 00	-3.04890E-02	3.34707E 00
25	-1.54424E 00	3.13695E-02	3.34193E 00
26	-1.53756E 00	3.13695E-02	3.34193E 00
27	-1.53088E 00	-3.23214E-02	3.33682E 00
28	-1.52421E 00	-3.23214E-02	3.33682E 00
29	-1.51754E 00	3.33427E-02	3.33173E 00
30	-1.51088E 00	3.33427E-02	3.33173E 00
31	-1.50422E 00	-3.44302E-02	3.32666E 00
32	-1.49756E 00	-3.44302E-02	3.32666E 00
33	-1.49092E 00	3.55837E-02	3.32162E 00
34	-1.48427E 00	3.55837E-02	3.32162E 00
35	-1.47763E 00	-3.67992E-02	3.31660E 00
36	-1.47100E 00	-3.67992E-02	3.31660E 00
37	-1.46437E 00	3.80765E-02	3.31160E 00
38	-1.45775E 00	3.80765E-02	3.31160E 00
39	-1.45113E 00	-3.94123E-02	3.30663E 00
40	-1.44452E 00	-3.94123E-02	3.30663E 00
41	-1.43791E 00	4.08054E-02	3.30167E 00
42	-1.43131E 00	4.08054E-02	3.30167E 00
43	-1.42471E 00	-4.22527E-02	3.29674E 00
44	-1.41811E 00	-4.22527E-02	3.29674E 00
45	-1.41153E 00	4.37537E-02	3.29183E 00
46	-1.40494E 00	4.37537E-02	3.29183E 00
47	-1.39836E 00	-4.53049E-02	3.28695E 00
48	-1.39179E 00	-4.53049E-02	3.28695E 00
49	-1.38522E 00	4.69058E-02	3.28208E 00
50	-1.37866E 00	4.69058E-02	3.28208E 00

TRANSDUCER NAME: ECOMMT PCLN HAMMING APODIZED TRANSDUCER
DATE: JAN 18,1978
REF DES: MT2
TOTAL NUMBER OF ELECTRODE STRIPES: 602

SIZE	FSCM NO.	DRAWING NO.	REV
A	05869	1950523	
SCALE: NONE		SHEET	18

STRIPE NO.	DIM X STRIPE LOCATION	DIM Y BREAK LOCATION	DIM S STRIPE WIDTH
51	-1.37210E 00	-4.85527E-02	3.27724E 00
52	-1.36554E 00	-4.85527E-02	3.27724E 00
53	-1.35899E 00	5.02453E-02	3.27241E 00
54	-1.35245E 00	5.02453E-02	3.27241E 00
55	-1.34591E 00	-5.19797E-02	3.26761E 00
56	-1.33937E 00	-5.19797E-02	3.26761E 00
57	-1.33284E 00	5.37556E-02	3.26283E 00
58	-1.32632E 00	5.37556E-02	3.26283E 00
59	-1.31980E 00	-5.55714E-02	3.25807E 00
60	-1.31328E 00	-5.55714E-02	3.25807E 00
61	-1.30677E 00	5.74231E-02	3.25333E 00
62	-1.30026E 00	5.74231E-02	3.25333E 00
63	-1.29376E 00	-5.93101E-02	3.24862E 00
64	-1.28726E 00	-5.93101E-02	3.24862E 00
65	-1.28077E 00	6.12310E-02	3.24392E 00
66	-1.27428E 00	6.12310E-02	3.24392E 00
67	-1.26780E 00	-6.31815E-02	3.23924E 00
68	-1.26132E 00	-6.31815E-02	3.23924E 00
69	-1.25485E 00	6.51630E-02	3.23459E 00
70	-1.24838E 00	6.51630E-02	3.23459E 00
71	-1.24191E 00	-6.71712E-02	3.22995E 00
72	-1.23545E 00	-6.71712E-02	3.22995E 00
73	-1.22900E 00	6.92055E-02	3.22533E 00
74	-1.22255E 00	6.92055E-02	3.22533E 00
75	-1.21610E 00	-7.12628E-02	3.22073E 00
76	-1.20966E 00	-7.12628E-02	3.22073E 00
77	-1.20322E 00	7.33421E-02	3.21616E 00
78	-1.19679E 00	7.33421E-02	3.21616E 00
79	-1.19036E 00	-7.54420E-02	3.21160E 00
80	-1.18394E 00	-7.54420E-02	3.21160E 00
81	-1.17752E 00	7.75601E-02	3.20706E 00
82	-1.17111E 00	7.75601E-02	3.20706E 00
83	-1.16470E 00	-7.96950E-02	3.20254E 00
84	-1.15829E 00	-7.96950E-02	3.20254E 00
85	-1.15189E 00	8.18451E-02	3.19804E 00
86	-1.14549E 00	8.18451E-02	3.19804E 00
87	-1.13910E 00	-8.40066E-02	3.19356E 00
88	-1.13272E 00	-8.40066E-02	3.19356E 00
89	-1.12633E 00	8.61806E-02	3.18910E 00
90	-1.11996E 00	8.61806E-02	3.18910E 00
91	-1.11358E 00	-8.83644E-02	3.18465E 00
92	-1.10721E 00	-8.83644E-02	3.18465E 00
93	-1.10085E 00	9.05557E-02	3.18023E 00
94	-1.09449E 00	9.05557E-02	3.18023E 00
95	-1.08813E 00	-9.27548E-02	3.17582E 00
96	-1.08178E 00	-9.27548E-02	3.17582E 00
97	-1.07543E 00	9.49568E-02	3.17143E 00
98	-1.06909E 00	9.49568E-02	3.17143E 00
99	-1.06275E 00	-9.71629E-02	3.16706E 00
100	-1.05642E 00	-9.71629E-02	3.16706E 00

TRANSDUCER NAME: ECOMMT PCLN HAMMING APODIZED TRANSDUCER
DATE: JAN 18,1978
REF DES: MT2
TOTAL NUMBER OF ELECTRODE STRIPES: 602

SIZE	FSCM NO.	DRAWING NO.	REV
A	05869	1950523	
SCALE: NONE		SHEET	19

STRIPE NO.	DIM X STRIPE LOCATION	DIM Y BREAK LOCATION	DIM S STRIPE WIDTH
101	-1.05009E 00	9.93702E-02	3.16271E 00
102	-1.04376E 00	9.93702E-02	3.16271E 00
103	-1.03744E 00	-1.01579E-01	3.15837E 00
104	-1.03112E 00	-1.01579E-01	3.15837E 00
105	-1.02481E 00	1.03785E-01	3.15405E 00
106	-1.01850E 00	1.03785E-01	3.15405E 00
107	-1.01220E 00	-1.05987E-01	3.14975E 00
108	-1.00590E 00	-1.05987E-01	3.14975E 00
109	-9.99605E-01	1.08186E-01	3.14547E 00
110	-9.93314E-01	1.08186E-01	3.14547E 00
111	-9.87027E-01	-1.10380E-01	3.14121E 00
112	-9.80745E-01	-1.10380E-01	3.14121E 00
113	-9.74467E-01	1.12565E-01	3.13696E 00
114	-9.68193E-01	1.12565E-01	3.13696E 00
115	-9.61923E-01	-1.14742E-01	3.13273E 00
116	-9.55658E-01	-1.14742E-01	3.13273E 00
117	-9.49396E-01	1.16910E-01	3.12852E 00
118	-9.43139E-01	1.16910E-01	3.12852E 00
119	-9.36887E-01	-1.19065E-01	3.12432E 00
120	-9.30638E-01	-1.19065E-01	3.12432E 00
121	-9.24393E-01	1.21208E-01	3.12014E 00
122	-9.18153E-01	1.21208E-01	3.12014E 00
123	-9.11917E-01	-1.23338E-01	3.11598E 00
124	-9.05685E-01	-1.23338E-01	3.11598E 00
125	-8.99457E-01	1.25452E-01	3.11183E 00
126	-8.93234E-01	1.25452E-01	3.11183E 00
127	-8.87014E-01	-1.27549E-01	3.10770E 00
128	-8.80799E-01	-1.27549E-01	3.10770E 00
129	-8.74587E-01	1.29629E-01	3.10359E 00
130	-8.68380E-01	1.29629E-01	3.10359E 00
131	-8.62177E-01	-1.31691E-01	3.09949E 00
132	-8.55978E-01	-1.31691E-01	3.09949E 00
133	-8.49783E-01	1.33732E-01	3.09541E 00
134	-8.43592E-01	1.33732E-01	3.09541E 00
135	-8.37406E-01	-1.35753E-01	3.09135E 00
136	-8.31223E-01	-1.35753E-01	3.09135E 00
137	-8.25044E-01	1.37752E-01	3.08730E 00
138	-8.18870E-01	1.37752E-01	3.08730E 00
139	-8.12699E-01	-1.39728E-01	3.08327E 00
140	-8.06533E-01	-1.39728E-01	3.08327E 00
141	-8.00370E-01	1.41679E-01	3.07925E 00
142	-7.94212E-01	1.41679E-01	3.07925E 00
143	-7.88057E-01	-1.43605E-01	3.07525E 00
144	-7.81907E-01	-1.43605E-01	3.07525E 00
145	-7.75760E-01	1.45505E-01	3.07126E 00
146	-7.69617E-01	1.45505E-01	3.07126E 00
147	-7.63479E-01	-1.47379E-01	3.06729E 00
148	-7.57344E-01	-1.47379E-01	3.06729E 00
149	-7.51214E-01	1.49224E-01	3.06334E 00
150	-7.45087E-01	1.49224E-01	3.06334E 00

TRANSDUCER NAME: ECOMMT PCLN HAMMING APODIZED TRANSDUCER
DATE: JAN 18,1978
REF DES: MT2
TOTAL NUMBER OF ELECTRODE STRIPES: 602

SIZE	FSCM NO.	DRAWING NO.	REV
A	05869	1950523	
SCALE: NONE		SHEET	20

STRIPE NO.	DIM X STRIPE LOCATION	DIM Y BREAK LOCATION	DIM S STRIPE WIDTH
151	-7.38964E-01	-1.51041E-01	3.05940E 00
152	-7.32845E-01	-1.51041E-01	3.05940E 00
153	-7.26731E-01	1.52828E-01	3.05547E 00
154	-7.20620E-01	1.52828E-01	3.05547E 00
155	-7.14513E-01	-1.54584E-01	3.05157E 00
156	-7.08409E-01	-1.54584E-01	3.05157E 00
157	-7.02310E-01	1.56309E-01	3.04767E 00
158	-6.96215E-01	1.56309E-01	3.04767E 00
159	-6.90123E-01	-1.58002E-01	3.04379E 00
160	-6.84036E-01	-1.58002E-01	3.04379E 00
161	-6.77952E-01	1.59662E-01	3.03993E 00
162	-6.71872E-01	1.59662E-01	3.03993E 00
163	-6.65796E-01	-1.61290E-01	3.03608E 00
164	-6.59724E-01	-1.61290E-01	3.03608E 00
165	-6.53656E-01	1.62883E-01	3.03224E 00
166	-6.47591E-01	1.62883E-01	3.03224E 00
167	-6.41531E-01	-1.64442E-01	3.02842E 00
168	-6.35474E-01	-1.64442E-01	3.02842E 00
169	-6.29421E-01	1.65964E-01	3.02462E 00
170	-6.23372E-01	1.65964E-01	3.02462E 00
171	-6.17326E-01	-1.67451E-01	3.02082E 00
172	-6.11284E-01	-1.67451E-01	3.02082E 00
173	-6.05247E-01	1.68902E-01	3.01705E 00
174	-5.99213E-01	1.68902E-01	3.01705E 00
175	-5.93182E-01	-1.70316E-01	3.01328E 00
176	-5.87156E-01	-1.70316E-01	3.01328E 00
177	-5.81133E-01	1.71692E-01	3.00953E 00
178	-5.75114E-01	1.71692E-01	3.00953E 00
179	-5.69098E-01	-1.73030E-01	3.00579E 00
180	-5.63087E-01	-1.73030E-01	3.00579E 00
181	-5.57079E-01	1.74329E-01	3.00207E 00
182	-5.51075E-01	1.74329E-01	3.00207E 00
183	-5.45074E-01	-1.75590E-01	2.99837E 00
184	-5.39078E-01	-1.75590E-01	2.99837E 00
185	-5.33085E-01	1.76812E-01	2.99467E 00
186	-5.27095E-01	1.76812E-01	2.99467E 00
187	-5.21110E-01	-1.77993E-01	2.99099E 00
188	-5.15128E-01	-1.77993E-01	2.99099E 00
189	-5.09149E-01	1.79135E-01	2.98732E 00
190	-5.03175E-01	1.79135E-01	2.98732E 00
191	-4.97204E-01	-1.80236E-01	2.98367E 00
192	-4.91236E-01	-1.80236E-01	2.98367E 00
193	-4.85273E-01	1.81296E-01	2.98003E 00
194	-4.79313E-01	1.81296E-01	2.98003E 00
195	-4.73356E-01	-1.82315E-01	2.97640E 00
196	-4.67403E-01	-1.82315E-01	2.97640E 00
197	-4.61454E-01	1.83294E-01	2.97278E 00
198	-4.55509E-01	1.83294E-01	2.97278E 00
199	-4.49567E-01	-1.84231E-01	2.96919E 00
200	-4.43628E-01	-1.84231E-01	2.96919E 00

TRANSDUCER NAME: ECOMMT PCLN HAMMING APODIZED TRANSDUCER
DATE: JAN 18,1978
REF DES: MT2
TOTAL NUMBER OF ELECTRODE STRIPES: 602

SIZE	FSCM NO.	DRAWING NO.	REV
A	05869	1950523	
SCALE: NONE		SHEET	21

STRIPE NO.	DIM X STRIPE LOCATION	DIM Y BREAK LOCATION	DIM S STRIPE WIDTH
201	-4.37694E-01	1.85126E-01	2.96560E 00
202	-4.31762E-01	1.85126E-01	2.96560E 00
203	-4.25835E-01	-1.85980E-01	2.96202E 00
204	-4.19911E-01	-1.85980E-01	2.96202E 00
205	-4.13990E-01	1.86791E-01	2.95846E 00
206	-4.08073E-01	1.86791E-01	2.95846E 00
207	-4.02160E-01	-1.87560E-01	2.95491E 00
208	-3.96250E-01	-1.87560E-01	2.95491E 00
209	-3.90344E-01	1.88288E-01	2.95138E 00
210	-3.84441E-01	1.88288E-01	2.95138E 00
211	-3.78542E-01	-1.88973E-01	2.94785E 00
212	-3.72646E-01	-1.88973E-01	2.94785E 00
213	-3.66754E-01	1.89615E-01	2.94434E 00
214	-3.60865E-01	1.89615E-01	2.94434E 00
215	-3.54980E-01	-1.90215E-01	2.94084E 00
216	-3.49098E-01	-1.90215E-01	2.94084E 00
217	-3.43220E-01	1.90773E-01	2.93736E 00
218	-3.37345E-01	1.90773E-01	2.93736E 00
219	-3.31474E-01	-1.91289E-01	2.93368E 00
220	-3.25606E-01	-1.91289E-01	2.93388E 00
221	-3.19742E-01	1.91762E-01	2.93042E 00
222	-3.13881E-01	1.91762E-01	2.93042E 00
223	-3.08024E-01	-1.92193E-01	2.92697E 00
224	-3.02170E-01	-1.92193E-01	2.92697E 00
225	-2.96319E-01	1.92582E-01	2.92353E 00
226	-2.90472E-01	1.92582E-01	2.92353E 00
227	-2.84629E-01	-1.92928E-01	2.92011E 00
228	-2.78788E-01	-1.92928E-01	2.92011E 00
229	-2.72952E-01	1.93233E-01	2.91669E 00
230	-2.67118E-01	1.93233E-01	2.91669E 00
231	-2.61288E-01	-1.93495E-01	2.91330E 00
232	-2.55462E-01	-1.93495E-01	2.91330E 00
233	-2.49638E-01	1.93716E-01	2.90991E 00
234	-2.43819E-01	1.93716E-01	2.90991E 00
235	-2.38002E-01	-1.93895E-01	2.90653E 00
236	-2.32189E-01	-1.93895E-01	2.90653E 00
237	-2.26380E-01	1.94032E-01	2.90316E 00
238	-2.20573E-01	1.94032E-01	2.90316E 00
239	-2.14770E-01	-1.94129E-01	2.89981E 00
240	-2.08971E-01	-1.94129E-01	2.89981E 00
241	-2.03174E-01	1.94184E-01	2.89647E 00
242	-1.97381E-01	1.94184E-01	2.89647E 00
243	-1.91592E-01	-1.94198E-01	2.89314E 00
244	-1.85805E-01	-1.94198E-01	2.89314E 00
245	-1.80023E-01	1.94172E-01	2.88982E 00
246	-1.74243E-01	1.94172E-01	2.88982E 00
247	-1.68467E-01	-1.94106E-01	2.88651E 00
248	-1.62694E-01	-1.94106E-01	2.88651E 00
249	-1.56924E-01	1.93999E-01	2.88321E 00
250	-1.51157E-01	1.93999E-01	2.88321E 00

TRANSDUCER NAME: ECOMMT PCLN HAMMING APODIZED TRANSDUCER
DATE: JAN 18,1978
REF DES: MT2
TOTAL NUMBER OF ELECTRODE STRIPES: 602

SIZE	FSCM NO.	DRAWING NO.	REV
A	05869	1950523	
SCALE: NONE		SHEET	22

STRIPE NO.	DIM X STRIPE LOCATION	DIM Y BREAK LOCATION	DIM S STRIPE WIDTH
251	-1.45394E-01	-1.93853E-01	2.87993E 00
252	-1.39634E-01	-1.93853E-01	2.87993E 00
253	-1.33878E-01	1.93668E-01	2.87665E 00
254	-1.28125E-01	1.93668E-01	2.87665E 00
255	-1.22374E-01	-1.93443E-01	2.87339E 00
256	-1.16628E-01	-1.93443E-01	2.87339E 00
257	-1.10884E-01	1.93180E-01	2.87014E 00
258	-1.05144E-01	1.93180E-01	2.87014E 00
259	-9.94069E-02	-1.92879E-01	2.86690E 00
260	-9.36731E-02	-1.92879E-01	2.86690E 00
261	-8.79425E-02	1.92539E-01	2.86367E 00
262	-8.22152E-02	1.92539E-01	2.86367E 00
263	-7.64911E-02	-1.92162E-01	2.86045E 00
264	-7.07702E-02	-1.92162E-01	2.86045E 00
265	-6.50525E-02	1.91747E-01	2.85724E 00
266	-5.93380E-02	1.91747E-01	2.85724E 00
267	-5.36268E-02	-1.91296E-01	2.85404E 00
268	-4.79187E-02	-1.91296E-01	2.85404E 00
269	-4.22138E-02	1.90808E-01	2.85085E 00
270	-3.65121E-02	1.90808E-01	2.85085E 00
271	-3.08135E-02	-1.90285E-01	2.84768E 00
272	-2.51182E-02	-1.90285E-01	2.84768E 00
273	-1.94260E-02	1.89725E-01	2.84451E 00
274	-1.37370E-02	1.89725E-01	2.84451E 00
275	-8.05110E-03	-1.89131E-01	2.84136E 00
276	-2.36839E-03	-1.89131E-01	2.84136E 00
277	3.31118E-03	1.88503E-01	2.83821E 00
278	8.98761E-03	1.88503E-01	2.83821E 00
279	1.46609E-02	-1.87840E-01	2.83508E 00
280	2.03311E-02	-1.87840E-01	2.83508E 00
281	2.59981E-02	1.87143E-01	2.83196E 00
282	3.16620E-02	1.87143E-01	2.83196E 00
283	3.73228E-02	-1.86414E-01	2.82884E 00
284	4.29805E-02	-1.86414E-01	2.82884E 00
285	4.86351E-02	1.85651E-01	2.82574E 00
286	5.42866E-02	1.85651E-01	2.82574E 00
287	5.99350E-02	-1.84857E-01	2.82265E 00
288	6.55802E-02	-1.84857E-01	2.82265E 00
289	7.12224E-02	1.84031E-01	2.81956E 00
290	7.68616E-02	1.84031E-01	2.81956E 00
291	8.24976E-02	-1.83174E-01	2.81649E 00
292	8.81306E-02	-1.83174E-01	2.81649E 00
293	9.37605E-02	1.82286E-01	2.81343E 00
294	9.93873E-02	1.82286E-01	2.81343E 00
295	1.05011E-01	-1.81369E-01	2.81038E 00
296	1.10632E-01	-1.81369E-01	2.81038E 00
297	1.16250E-01	1.80422E-01	2.80733E 00
298	1.21864E-01	1.80422E-01	2.80733E 00
299	1.27476E-01	-1.79446E-01	2.80430E 00
300	1.33085E-01	-1.79446E-01	2.80430E 00

TRANSDUCER NAME: ECOMMT PCLN HAMMING APODIZED TRANSDUCER
DATE: JAN 18,1978
REF DES: MT2
TOTAL NUMBER OF ELECTRODE STRIPES: 602

SIZE	FSCM NO.	DRAWING NO.	REV
A	05869	1950523	
SCALE: NONE		SHEET	23

STRIPE NO.	DIM X STRIPE LOCATION	DIM Y BREAK LOCATION	DIM S STRIPE WIDTH
301	1.38690E-01	1.78442E-01	2.80128E 00
302	1.44293E-01	1.78442E-01	2.80128E 00
303	1.49892E-01	-1.77410E-01	2.79826E 00
304	1.55489E-01	-1.77410E-01	2.79826E 00
305	1.61082E-01	1.76351E-01	2.79526E 00
306	1.66673E-01	1.76351E-01	2.79526E 00
307	1.72260E-01	-1.75265E-01	2.79226E 00
308	1.77845E-01	-1.75265E-01	2.79226E 00
309	1.83426E-01	1.74154E-01	2.78928E 00
310	1.89005E-01	1.74154E-01	2.78928E 00
311	1.94580E-01	-1.73017E-01	2.78630E 00
312	2.00153E-01	-1.73017E-01	2.78630E 00
313	2.05723E-01	1.71855E-01	2.78334E 00
314	2.11289E-01	1.71855E-01	2.78334E 00
315	2.16853E-01	-1.70669E-01	2.78038E 00
316	2.22414E-01	-1.70669E-01	2.78038E 00
317	2.27972E-01	1.69460E-01	2.77744E 00
318	2.33527E-01	1.69460E-01	2.77744E 00
319	2.39079E-01	-1.68227E-01	2.77450E 00
320	2.44628E-01	-1.68227E-01	2.77450E 00
321	2.50174E-01	1.66973E-01	2.77157E 00
322	2.55717E-01	1.66973E-01	2.77157E 00
323	2.61257E-01	-1.65696E-01	2.76865E 00
324	2.66794E-01	-1.65696E-01	2.76865E 00
325	2.72329E-01	1.64398E-01	2.76574E 00
326	2.77860E-01	1.64398E-01	2.76574E 00
327	2.83389E-01	-1.63080E-01	2.76284E 00
328	2.88915E-01	-1.63080E-01	2.76284E 00
329	2.94437E-01	1.61742E-01	2.75995E 00
330	2.99957E-01	1.61742E-01	2.75995E 00
331	3.05474E-01	-1.60385E-01	2.75707E 00
332	3.10988E-01	-1.60385E-01	2.75707E 00
333	3.16500E-01	1.59009E-01	2.75420E 00
334	3.22008E-01	1.59009E-01	2.75420E 00
335	3.27514E-01	-1.57615E-01	2.75133E 00
336	3.33016E-01	-1.57615E-01	2.75133E 00
337	3.38516E-01	1.56205E-01	2.74848E 00
338	3.44013E-01	1.56205E-01	2.74848E 00
339	3.49507E-01	-1.54777E-01	2.74563E 00
340	3.54998E-01	-1.54777E-01	2.74563E 00
341	3.60487E-01	1.53333E-01	2.74279E 00
342	3.65972E-01	1.53333E-01	2.74279E 00
343	3.71455E-01	-1.51873E-01	2.73996E 00
344	3.76935E-01	-1.51873E-01	2.73996E 00
345	3.82412E-01	1.50399E-01	2.73714E 00
346	3.87886E-01	1.50399E-01	2.73714E 00
347	3.93358E-01	-1.48911E-01	2.73433E 00
348	3.98827E-01	-1.48911E-01	2.73433E 00
349	4.04292E-01	1.47408E-01	2.73153E 00
350	4.09756E-01	1.47408E-01	2.73153E 00

TRANSDUCER NAME: ECOMMT PCLN HAMMING APODIZED TRANSDUCER
DATE: JAN 18,1978
REF DES: MT2
TOTAL NUMBER OF ELECTRODE STRIPES: 602

SIZE	FSCM NO.	DRAWING NO.	REV
A	05869	1950523	
SCALE: NONE		SHEET	24

STRIPE NO.	DIM X STRIPE LOCATION	DIM Y BREAK LOCATION	DIM S STRIPE WIDTH
351	4.15216E-01	-1.45894E-01	2.72873E 00
352	4.20673E-01	-1.45894E-01	2.72873E 00
353	4.26128E-01	1.44366E-01	2.72595E 00
354	4.31580E-01	1.44366E-01	2.72595E 00
355	4.37029E-01	-1.42827E-01	2.72317E 00
356	4.42475E-01	-1.42827E-01	2.72317E 00
357	4.47919E-01	1.41277E-01	2.72040E 00
358	4.53360E-01	1.41277E-01	2.72040E 00
359	4.58798E-01	-1.39717E-01	2.71764E 00
360	4.64233E-01	-1.39717E-01	2.71764E 00
361	4.69666E-01	1.38146E-01	2.71489E 00
362	4.75095E-01	1.38146E-01	2.71489E 00
363	4.80522E-01	-1.36567E-01	2.71215E 00
364	4.85947E-01	-1.36567E-01	2.71215E 00
365	4.91368E-01	1.34978E-01	2.70941E 00
366	4.96787E-01	1.34978E-01	2.70941E 00
367	5.02203E-01	-1.33382E-01	2.70669E 00
368	5.07617E-01	-1.33382E-01	2.70669E 00
369	5.13027E-01	1.31778E-01	2.70397E 00
370	5.18435E-01	1.31778E-01	2.70397E 00
371	5.23840E-01	-1.30168E-01	2.70126E 00
372	5.29243E-01	-1.30168E-01	2.70126E 00
373	5.34643E-01	1.28551E-01	2.69855E 00
374	5.40040E-01	1.28551E-01	2.69855E 00
375	5.45434E-01	-1.26929E-01	2.69586E 00
376	5.50826E-01	-1.26929E-01	2.69586E 00
377	5.56215E-01	1.25302E-01	2.69317E 00
378	5.61601E-01	1.25302E-01	2.69317E 00
379	5.66985E-01	-1.23671E-01	2.69050E 00
380	5.72366E-01	-1.23671E-01	2.69050E 00
381	5.77744E-01	1.22035E-01	2.68783E 00
382	5.83120E-01	1.22035E-01	2.68783E 00
383	5.88493E-01	-1.20397E-01	2.68516E 00
384	5.93863E-01	-1.20397E-01	2.68516E 00
385	5.99231E-01	1.18755E-01	2.68251E 00
386	6.04596E-01	1.18755E-01	2.68251E 00
387	6.09958E-01	-1.17112E-01	2.67986E 00
388	6.15318E-01	-1.17112E-01	2.67986E 00
389	6.20675E-01	1.15467E-01	2.67722E 00
390	6.26030E-01	1.15467E-01	2.67722E 00
391	6.31381E-01	-1.13821E-01	2.67459E 00
392	6.36731E-01	-1.13821E-01	2.67459E 00
393	6.42077E-01	1.12175E-01	2.67197E 00
394	6.47421E-01	1.12175E-01	2.67197E 00
395	6.52762E-01	-1.10529E-01	2.66935E 00
396	6.58101E-01	-1.10529E-01	2.66935E 00
397	6.63437E-01	1.08883E-01	2.66675E 00
398	6.68771E-01	1.08883E-01	2.66675E 00
399	6.74102E-01	-1.07239E-01	2.66415E 00
400	6.79430E-01	-1.07239E-01	2.66415E 00

TRANSDUCER NAME: ECOMMT PCLN HAMMING APODIZED TRANSDUCER
DATE: JAN 18,1978
REF DES: MT2
TOTAL NUMBER OF ELECTRODE STRIPES: 602

SIZE	FSCM NO.	DRAWING NO.	REV
A	05869	1950523	
SCALE: NONE		SHEET	25

STRIPE NO.	DIM X STRIPE LOCATION	DIM Y BREAK LOCATION	DIM S STRIPE WIDTH
401	6.84756E-01	1.05596E-01	2.66155E 00
402	6.90079E-01	1.05596E-01	2.66155E 00
403	6.95399E-01	-1.03956E-01	2.65897E 00
404	7.00717E-01	-1.03956E-01	2.65897E 00
405	7.06033E-01	1.02319E-01	2.65639E 00
406	7.11345E-01	1.02319E-01	2.65639E 00
407	7.16656E-01	-1.00685E-01	2.65382E 00
408	7.21963E-01	-1.00685E-01	2.65382E 00
409	7.27268E-01	9.90545E-02	2.65126E 00
410	7.32571E-01	9.90545E-02	2.65126E 00
411	7.37871E-01	-9.74287E-02	2.64870E 00
412	7.43168E-01	-9.74287E-02	2.64870E 00
413	7.48463E-01	9.58077E-02	2.64615E 00
414	7.53755E-01	9.58077E-02	2.64615E 00
415	7.59045E-01	-9.41920E-02	2.64361E 00
416	7.64332E-01	-9.41920E-02	2.64361E 00
417	7.69617E-01	9.25820E-02	2.64108E 00
418	7.74899E-01	9.25820E-02	2.64108E 00
419	7.80179E-01	-9.09784E-02	2.63855E 00
420	7.85456E-01	-9.09784E-02	2.63855E 00
421	7.90731E-01	8.93816E-02	2.63604E 00
422	7.96003E-01	8.93816E-02	2.63604E 00
423	8.01272E-01	-8.77919E-02	2.63352E 00
424	8.06539E-01	-8.77919E-02	2.63352E 00
425	8.11804E-01	8.62099E-02	2.63102E 00
426	8.17066E-01	8.62099E-02	2.63102E 00
427	8.22325E-01	-8.46361E-02	2.62852E 00
428	8.27582E-01	-8.46361E-02	2.62852E 00
429	8.32837E-01	8.30706E-02	2.62603E 00
430	8.38089E-01	8.30706E-02	2.62603E 00
431	8.43339E-01	-8.15144E-02	2.62355E 00
432	8.48586E-01	-8.15144E-02	2.62355E 00
433	8.53830E-01	7.99674E-02	2.62107E 00
434	8.59073E-01	7.99674E-02	2.62107E 00
435	8.64312E-01	-7.84303E-02	2.61861E 00
436	8.69549E-01	-7.84303E-02	2.61861E 00
437	8.74784E-01	7.69035E-02	2.61614E 00
438	8.80016E-01	7.69035E-02	2.61614E 00
439	8.85246E-01	-7.53872E-02	2.61369E 00
440	8.90474E-01	-7.53872E-02	2.61369E 00
441	8.95699E-01	7.38822E-02	2.61124E 00
442	9.00921E-01	7.38822E-02	2.61124E 00
443	9.06141E-01	-7.23884E-02	2.60880E 00
444	9.11359E-01	-7.23884E-02	2.60880E 00
445	9.16574E-01	7.09065E-02	2.60636E 00
446	9.21787E-01	7.09065E-02	2.60636E 00
447	9.26997E-01	-6.94367E-02	2.60394E 00
448	9.32205E-01	-6.94367E-02	2.60394E 00
449	9.37410E-01	6.79796E-02	2.60152E 00
450	9.42613E-01	6.79796E-02	2.60152E 00

TRANSDUCER NAME: ECOMMT PCLN HAMMING APODIZED TRANSDUCER
DATE: JAN 18,1978
REF DES: MT2
TOTAL NUMBER OF ELECTRODE STRIPES: 602

SIZE	FSCM NO.	DRAWING NO.	REV
A	05869	1950523	
SCALE: NONE		SHEET	26

STRIPE NO.	DIM X STRIPE LOCATION	DIM Y BREAK LOCATION	DIM S STRIPE WIDTH
451	9.47814E-01	-6.65351E-02	2.59910E 00
452	9.53012E-01	-6.65351E-02	2.59910E 00
453	9.58208E-01	6.51041E-02	2.59669E 00
454	9.63401E-01	6.51041E-02	2.59669E 00
455	9.68592E-01	-6.36865E-02	2.59429E 00
456	9.73781E-01	-6.36865E-02	2.59429E 00
457	9.78967E-01	6.22829E-02	2.59190E 00
458	9.84151E-01	6.22829E-02	2.59190E 00
459	9.89332E-01	-6.08936E-02	2.58951E 00
460	9.94511E-01	-6.08936E-02	2.58951E 00
461	9.99688E-01	5.95187E-02	2.58713E 00
462	1.00486E 00	5.95187E-02	2.58713E 00
463	1.01003E 00	-5.81587E-02	2.58476E 00
464	1.01520E 00	-5.81587E-02	2.58476E 00
465	1.02037E 00	5.68141E-02	2.58239E 00
466	1.02553E 00	5.68141E-02	2.58239E 00
467	1.03070E 00	-5.54846E-02	2.58003E 00
468	1.03586E 00	-5.54846E-02	2.58003E 00
469	1.04102E 00	5.41709E-02	2.57767E 00
470	1.04617E 00	5.41709E-02	2.57767E 00
471	1.05132E 00	-5.28733E-02	2.57532E 00
472	1.05647E 00	-5.28733E-02	2.57532E 00
473	1.06162E 00	5.15919E-02	2.57298E 00
474	1.06677E 00	5.15919E-02	2.57298E 00
475	1.07191E 00	-5.03269E-02	2.57065E 00
476	1.07705E 00	-5.03269E-02	2.57065E 00
477	1.08219E 00	4.90788E-02	2.56832E 00
478	1.08733E 00	4.90788E-02	2.56832E 00
479	1.09246E 00	-4.78478E-02	2.56599E 00
480	1.09760E 00	-4.78478E-02	2.56599E 00
481	1.10273E 00	4.66339E-02	2.56368E 00
482	1.10785E 00	4.66339E-02	2.56368E 00
483	1.11298E 00	-4.54375E-02	2.56137E 00
484	1.11810E 00	-4.54375E-02	2.56137E 00
485	1.12322E 00	4.42588E-02	2.55906E 00
486	1.12834E 00	4.42588E-02	2.55906E 00
487	1.13345E 00	-4.30980E-02	2.55676E 00
488	1.13857E 00	-4.30980E-02	2.55676E 00
489	1.14368E 00	4.19552E-02	2.55447E 00
490	1.14879E 00	4.19552E-02	2.55447E 00
491	1.15389E 00	-4.08307E-02	2.55219E 00
492	1.15900E 00	-4.08307E-02	2.55219E 00
493	1.16410E 00	3.97247E-02	2.54991E 00
494	1.16920E 00	3.97247E-02	2.54991E 00
495	1.17430E 00	-3.86373E-02	2.54763E 00
496	1.17939E 00	-3.86373E-02	2.54763E 00
497	1.18449E 00	3.75688E-02	2.54537E 00
498	1.18958E 00	3.75688E-02	2.54537E 00
499	1.19467E 00	-3.65192E-02	2.54310E 00
500	1.19975E 00	-3.65192E-02	2.54310E 00

TRANSDUCER NAME: ECOMMT PCLN HAMMING APODIZED TRANSDUCER
DATE: JAN 18,1978
REF DES: MT2
TOTAL NUMBER OF ELECTRODE STRIPES: 602

SIZE	FSCM NO.	DRAWING NO.	REV
A	05869	1950523	
SCALE: NONE		SHEET	27

STRIPE NO.	DIM X STRIPE LOCATION	DIM Y BREAK LOCATION	DIM S STRIPE WIDTH
501	1.20484E 00	3.54887E-02	2.54085E 00
502	1.20992E 00	3.54887E-02	2.54085E 00
503	1.21500E 00	-3.44774E-02	2.53860E 00
504	1.22007E 00	-3.44774E-02	2.53860E 00
505	1.22515E 00	3.34857E-02	2.53636E 00
506	1.23022E 00	3.34857E-02	2.53636E 00
507	1.23529E 00	-3.25134E-02	2.53412E 00
508	1.24036E 00	-3.25134E-02	2.53412E 00
509	1.24543E 00	3.15608E-02	2.53189E 00
510	1.25049E 00	3.15608E-02	2.53189E 00
511	1.25555E 00	-3.06279E-02	2.52966E 00
512	1.26061E 00	-3.06279E-02	2.52966E 00
513	1.26567E 00	2.97148E-02	2.52744E 00
514	1.27072E 00	2.97148E-02	2.52744E 00
515	1.27578E 00	-2.88219E-02	2.52523E 00
516	1.28083E 00	-2.88219E-02	2.52523E 00
517	1.28588E 00	2.79489E-02	2.52302E 00
518	1.29092E 00	2.79489E-02	2.52302E 00
519	1.29597E 00	-2.70960E-02	2.52082E 00
520	1.30101E 00	-2.70960E-02	2.52082E 00
521	1.30605E 00	2.62633E-02	2.51862E 00
522	1.31108E 00	2.62633E-02	2.51862E 00
523	1.31612E 00	-2.54509E-02	2.51643E 00
524	1.32115E 00	-2.54509E-02	2.51643E 00
525	1.32618E 00	2.46589E-02	2.51424E 00
526	1.33121E 00	2.46589E-02	2.51424E 00
527	1.33624E 00	-2.38871E-02	2.51206E 00
528	1.34126E 00	-2.38871E-02	2.51206E 00
529	1.34628E 00	2.31358E-02	2.50989E 00
530	1.35130E 00	2.31358E-02	2.50989E 00
531	1.35632E 00	-2.24051E-02	2.50772E 00
532	1.36134E 00	-2.24051E-02	2.50772E 00
533	1.36635E 00	2.16948E-02	2.50556E 00
534	1.37136E 00	2.16948E-02	2.50556E 00
535	1.37637E 00	-2.10051E-02	2.50340E 00
536	1.38138E 00	-2.10051E-02	2.50340E 00
537	1.38638E 00	2.03358E-02	2.50125E 00
538	1.39138E 00	2.03358E-02	2.50125E 00
539	1.39638E 00	-1.96872E-02	2.49911E 00
540	1.40138E 00	-1.96872E-02	2.49911E 00
541	1.40638E 00	1.90591E-02	2.49697E 00
542	1.41137E 00	1.90591E-02	2.49697E 00
543	1.41636E 00	-1.84515E-02	2.49483E 00
544	1.42135E 00	-1.84515E-02	2.49483E 00
545	1.42634E 00	1.78645E-02	2.49270E 00
546	1.43133E 00	1.78645E-02	2.49270E 00
547	1.43631E 00	-1.72980E-02	2.49058E 00
548	1.44129E 00	-1.72980E-02	2.49058E 00
549	1.44627E 00	1.67519E-02	2.48846E 00
550	1.45125E 00	1.67519E-02	2.48846E 00

TRANSDUCER NAME: ECOMMT PCLN HAMMING APODIZED TRANSDUCER
DATE: JAN 18,1978
REF DES: MT2
TOTAL NUMBER OF ELECTRODE STRIPES: 602

SIZE	FSCM NO.	DRAWING NO.	REV
A	05869	1950523	
SCALE: NONE		SHEET	28

STRIPE NO.	DIM X STRIPE LOCATION	DIM Y BREAK LOCATION	DIM S STRIPE WIDTH
551	1.45622E 00	-1.62263E-02	2.48634E 00
552	1.46119E 00	-1.62263E-02	2.48634E 00
553	1.46616E 00	1.57212E-02	2.48424E 00
554	1.47113E 00	1.57212E-02	2.48424E 00
555	1.47610E 00	-1.52365E-02	2.48213E 00
556	1.48106E 00	-1.52365E-02	2.48213E 00
557	1.48603E 00	1.47720E-02	2.48004E 00
558	1.49099E 00	1.47720E-02	2.48004E 00
559	1.49594E 00	-1.43280E-02	2.47795E 00
560	1.50090E 00	-1.43280E-02	2.47795E 00
561	1.50585E 00	1.39041E-02	2.47586E 00
562	1.51081E 00	1.39041E-02	2.47586E 00
563	1.51575E 00	-1.35003E-02	2.47378E 00
564	1.52070E 00	-1.35003E-02	2.47378E 00
565	1.52565E 00	1.31166E-02	2.47170E 00
566	1.53059E 00	1.31166E-02	2.47170E 00
567	1.53553E 00	-1.27529E-02	2.46963E 00
568	1.54047E 00	-1.27529E-02	2.46963E 00
569	1.54541E 00	1.24092E-02	2.46756E 00
570	1.55034E 00	1.24092E-02	2.46756E 00
571	1.55528E 00	-1.20852E-02	2.46550E 00
572	1.56021E 00	-1.20852E-02	2.46550E 00
573	1.56514E 00	1.17810E-02	2.46345E 00
574	1.57006E 00	1.17810E-02	2.46345E 00
575	1.57499E 00	-1.14965E-02	2.46140E 00
576	1.57991E 00	-1.14965E-02	2.46140E 00
577	1.58483E 00	1.12314E-02	2.45935E 00
578	1.58975E 00	1.12314E-02	2.45935E 00
579	1.59467E 00	-1.09858E-02	2.45731E 00
580	1.59958E 00	-1.09858E-02	2.45731E 00
581	1.60450E 00	1.07594E-02	2.45528E 00
582	1.60941E 00	1.07594E-02	2.45528E 00
583	1.61431E 00	-1.05522E-02	2.45325E 00
584	1.61922E 00	-1.05522E-02	2.45325E 00
585	1.62413E 00	1.03641E-02	2.45122E 00
586	1.62903E 00	1.03641E-02	2.45122E 00
587	1.63393E 00	-1.01949E-02	2.44920E 00
588	1.63883E 00	-1.01949E-02	2.44920E 00
589	1.64372E 00	1.00444E-02	2.44719E 00
590	1.64862E 00	1.00444E-02	2.44719E 00
591	1.65351E 00	-9.91262E-03	2.44518E 00
592	1.65840E 00	-9.91262E-03	2.44518E 00
593	1.66329E 00	9.79926E-03	2.44317E 00
594	1.66817E 00	9.79926E-03	2.44317E 00
595	1.67306E 00	-9.70429E-03	2.44117E 00
596	1.67794E 00	-9.70429E-03	2.44117E 00
597	1.68282E 00	9.62749E-03	2.43918E 00
598	1.68770E 00	9.62749E-03	2.43918E 00
599	1.69258E 00	-9.56869E-03	2.43719E 00
600	1.69745E 00	-9.56869E-03	2.43719E 00

TRANSDUCER NAME: ECOMMT PCLN HAMMING APODIZED TRANSDUCER
DATE: JAN 18,1978
REF DES: MT2
TOTAL NUMBER OF ELECTRODE STRIPES: 602

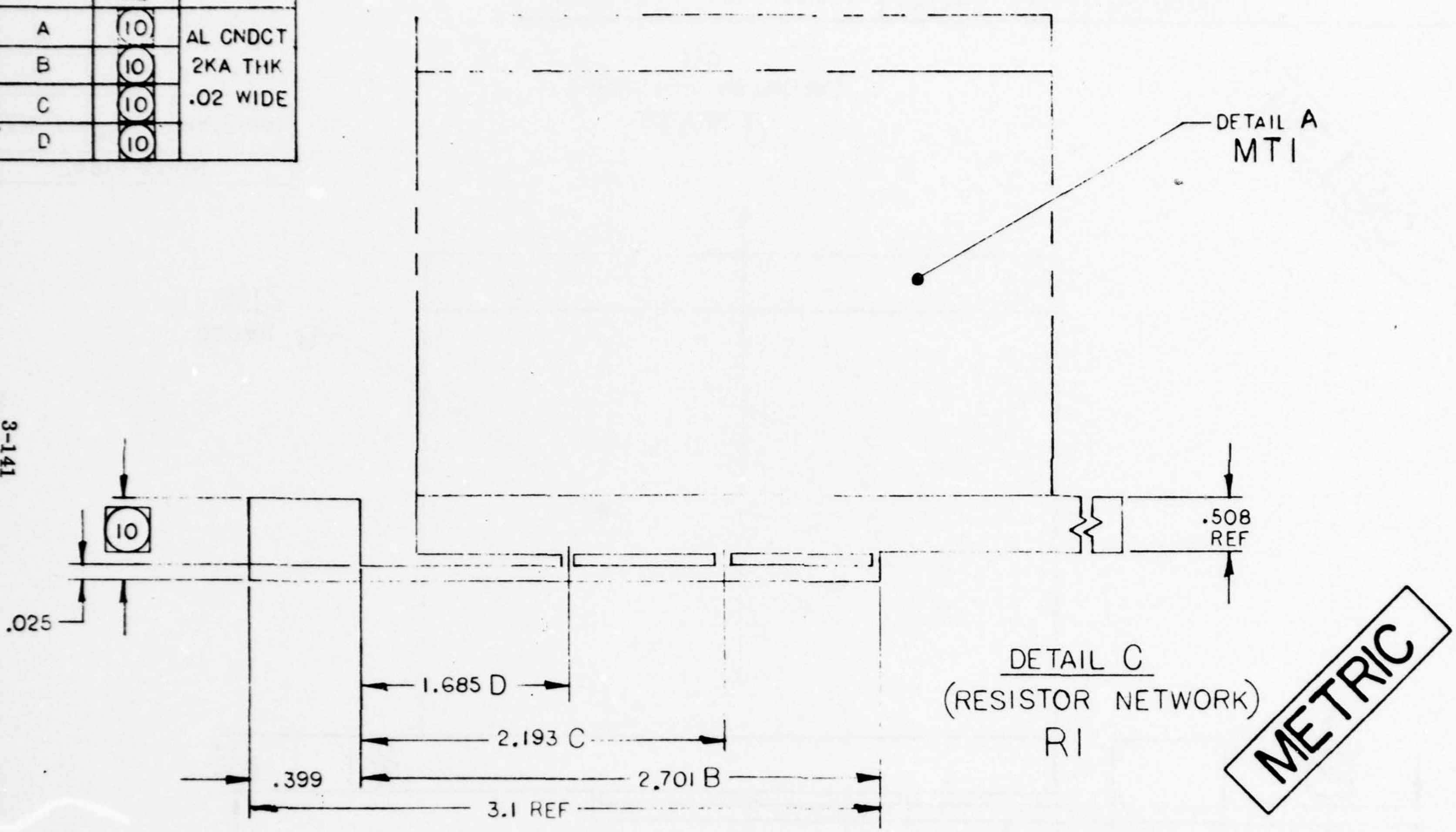
SIZE A — FSCM NO. 05869 — DRAWING NO. 1950523 — REV
SCALE: NONE — SHEET 29

STRIPE NO.	DIM X STRIPE LOCATION	DIM Y BREAK LOCATION	DIM S STRIPE WIDTH
601	1.70232E 00	9.52778E-03	2.43520E 00
602	1.70719E 00	9.52778E-03	2.43520E 00

TRANSDUCER NAME: ECOMMT PCLN HAMMING APODIZED TRANSDUCER
DATE: JAN 18,1978
REF DES: MT2
TOTAL NUMBER OF ELECTRODE STRIPES: 602

SIZE	FSCM NO.	DRAWING NO.	REV
A	05869	1950523	
SCALE: NONE		SHEET	30

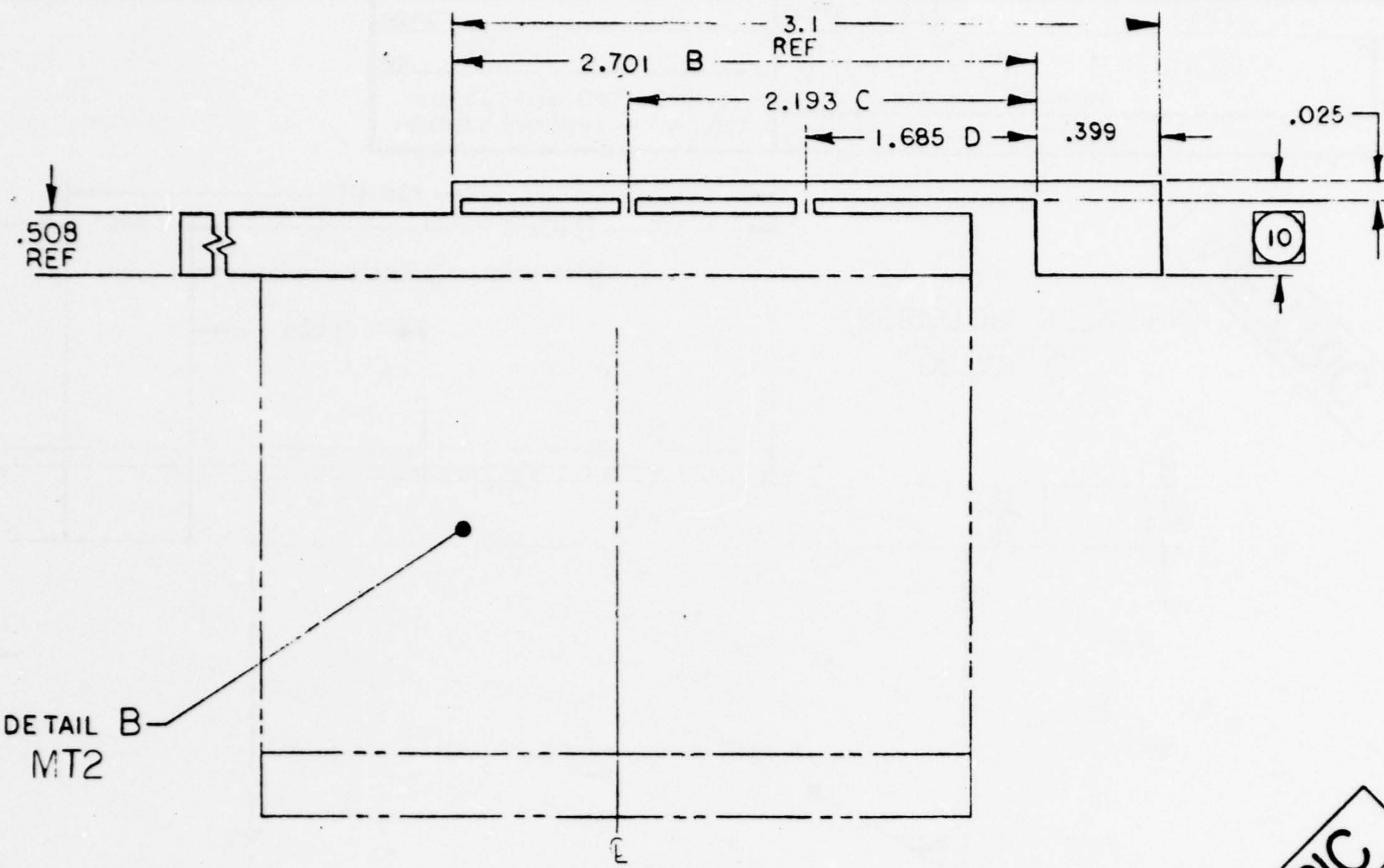
TABULATION		
LENGTH	NO OF SQ.	MATERIAL
A	10	AL CNDCT
B	10	2KA THK
C	10	.02 WIDE
D	10	



DETAIL C
(RESISTOR NETWORK)
R1

METRIC

HUGHES AIRCRAFT COMPANY FULLERTON, CALIFORNIA	CONTRACT: DAAB07-75C-0074			
DR K. KELLY	SIZE A	FSCM NO. 05869	DWG NO. 1950523	REV
ISSUED	SCALE NONE		SHEET 31	



DETAIL D
(RESISTOR NETWORK)
R2

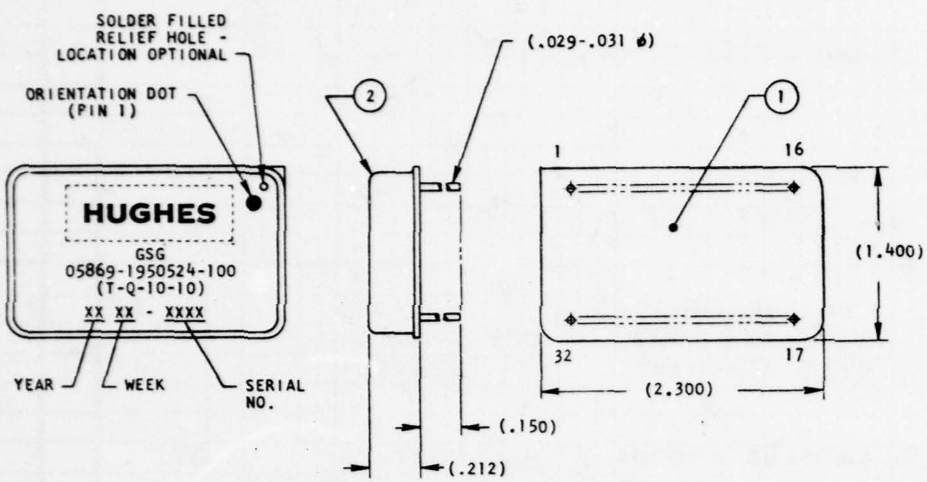
METRIC

TABULATION		
LENGTH	NO. OF SQ	MATERIAL
A	10	AL CNDCT 2KA THK .02 WIDE
B	10	
C	10	
D	10	

HUGHES AIRCRAFT COMPANY FULLERTON, CALIFORNIA	CONTRACT: DAAB07-75C-0074			
	SIZE A	FSCM NO. 05869	DWG NO. 1950523	REV
DR K. KELLY				
ISSUED	SCALE NONE		SHEET 32	

92508-6

REVISIONS					
AUTHORITY	ZONE	LTR	DESCRIPTION	DATE	APPROVED
DDT 74356		-	PRODUCTION RELEASE	77-11-10	



NOTES - UNLESS OTHERWISE SPECIFIED

1. FOR SCHEMATIC DIAGRAM SEE 1950525.
2. THIS ITEM SHALL MEET THE REQUIREMENTS OF 1950512-600.
3. IDENTIFICATION MARKING PER P80-3.
4. SEAL ASSEMBLY USING ITEM 3 OR BY PROJECTION WELDING (MFG OPTION).

SEE SEPARATE PARTS LIST

- / NEXT ASSY — SAW MMT / USED ON — APPLICATION	EXCEPT AS NOTED DIM. ARE IN INCHES AND PER ANS Y14.5 XXX ±.010 XX ±.03 ANGLES ±0°30' — MATERIAL	CONTRACT: DAAB07-75-C-0044 — DR 77-10-28 — CHK 77-10-29 — APPD 77-11-07	HUGHES — HUGHES AIRCRAFT COMPANY FULLERTON, CALIFORNIA — DELAY LINE, SURFACE ACOUSTIC WAVE — CENTER FREQ 100 MHz, BANDWIDTH 10 MHz (TAPPED DELAY LINE FORWARD CODE) — SIZE B CODE IDENT NO 05869 DRAWING NO. 1950524-100 — SCALE NONE SHEET

11-0638-1 GS 7/73 12-66-42 FORM 3

PARTS LIST TRANSMITTAL

HUGHES

HUGHES AIRCRAFT COMPANY
FULLERTON, CALIFORNIA

ISSUE: | ACTION: A

10 CONTRACT: DAAB07-75-C-0044

PL 1950524-100

CODE IDENT: 05869

11 REV: -

YR 77 MO 09 DAY 23

12 LIST TITLE: DELAY LINE, SAW

13 MAINT:

14 PROJECT: SAW MNT

15 REFERENCE NO.:

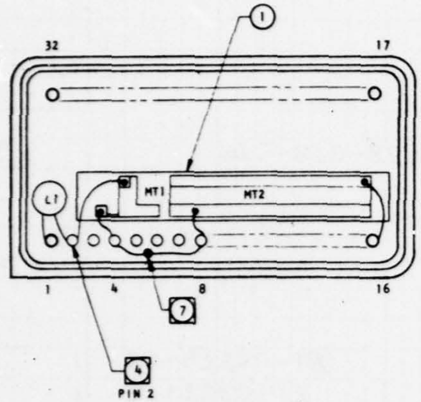
16 REV AUTH:

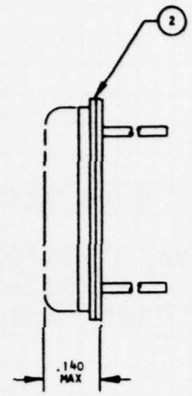
SHEET 1 OF 1

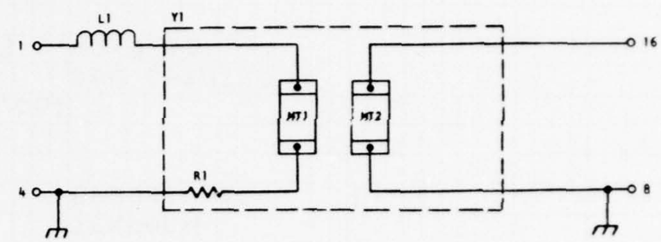
	ITEM NO.	LINE NO.	QUANTITY REQUIRED (20)	UNIT OF MEAS (21)	CODE IDENT (22)	PART OR IDENT NUMBER (23)	DESCRIPTION (24)	SPECIFICATION OR REFERENCE (25)	REF DESIGNATION FROM (26)	THRU (27)	AUTH (28)	WT LB (29)	NOTE
A	1		1			1950525	SUBASSY						
A	2		1		29172	20118-175	COVER	TEKFORM					
A	3		AR			4277250-996	SOLDER, SN96IW5	QQ-S-571					
A	1900		REF			1950525	SCHEMATIC DIAG						
A	1901		REF			1950512-600	DESGN PERF SPEC						
A	1902		REF			P80-3	IDENT MARKING						

	DATE	CHECKED BY	DATE	APPROVED BY	DATE	APPROVED BY	DATE
K. Burns	77-09-23		77-	[illegible]	77-11-09		77-

AUTHORITY	REVISIONS LTR	DESCRIPTION	DATE	APPROVED
DDT 74356	-	PRODUCTION RELEASE	77-11	







SCHEMATIC DIAGRAM

NOTES - UNLESS OTHERWISE SPECIFIED:

1. ATTACH ITEM 1 TO ITEM 2 USING ITEM 7.
2. SOLDER LEADS OF L1 TO HEADER PINS AS SHOWN USING ITEM 8.
3. ALL OTHER CONNECTIONS ARE WIRE BONDS PER MIL-STD-883, METHOD 2017 USING ITEM 6.
4. CLIP INDICATED PIN FLUSH WITH FAR SIDE OF HEADER.
5. (NOT USED)
6. *TUNE L1 TO MEET THE PERFORMANCE REQUIREMENTS* OF 19500512-600 BY ADJUSTING SPACING BETWEEN TURNS. THEN BOND TO ITEM 2 USING ITEM 7.
7. SOLDER CONNECTION TO HEADER AS SHOWN USING ITEM 8.

SEE SEPARATE PARTS LIST

1950524-100	SAW MMT	EXCEPT AS NOTED DIM ARE IN INCHES AND PER ANSI Y14.5 XXX XX ANGLES ±.010 ±.03 ±0.5°	CONTRACT: DAAB07-75-C-0044	HUGHES	HUGHES AIRCRAFT COMPANY FULLERTON, CALIFORNIA
NEXT ASSY	USED ON	MATERIAL	DR 77-11-08	DELAY LINE SUBASSEMBLY, SURFACE ACOUSTIC WAVE - CENTER FREQ 100 MHz, BANDWIDTH 10 MHz	
APPLICATION			CHK 77-11-09	SIZE C FSCM NO 05869	DWG NO 1950525 REV
			APPD 77-11	SCALE NONE	SHEET

12-67-31 FORM 3

FORM NO. 11064B-CS-GS REV. 7-76
DIETERICH-POST CLEARPRINT 1000H-10

92508-12

DWG NO 1950525 SH REV

A B C D

PARTS LIST TRANSMITTAL

HUGHES AIRCRAFT COMPANY
FULLERTON, CALIFORNIA

ISSUE: | ACTION: A | 10 CONTRACT: DAAB07-75-C-0044 | PL 1950525 | CODE IDENT 05869 | 11 REV – | 77 09 26 (YR MO DAY)

12 LIST TITLE: DELAY LINE SUBASSY, SAW | 13 MAINT: | 14 PROJECT: MMT | 15 REFERENCE NO.: | 16 REV AUTH: | SHEET 1 OF 1

	ITEM NO.	LINE NO.	QUANTITY REQUIRED (20)	UNIT OF MEAS (21)	CODE IDENT (22)	PART OR IDENT NUMBER (23)	DESCRIPTION (24)	SPECIFICATION OR REFERENCE (25)	REF DESIGNATION FROM (26)	THRU (27)	AUTH (28)	WT LB (29)	PL NOTE (30)
A	1		1			1950526	CRYSTAL		Y1				
A	2		1		29172	20117	HEADER	TEKFORM					
A	3		1		55167	850-18	COIL	CORONA MAG	L1				
N	4												
N	5												
A	6		AR			760660-11	WIRE, GOLD .001						
A	7		AR		71984	3140 RTV	ADHESIVE	DOW CORNING					
A	8		AR			4277250-999	SOLDER, SN63	QQ-S-571					
A	4900		REF			MIL-STD-883	WIRE BOND SPEC						

PREPARED BY: Ro. Burns | DATE: 77-09-26 | CHECKED BY: | DATE: 77- - | APPROVED BY: [signature] | DATE: 77-11-09 | APPROVED BY: | DATE: 77- -

17 314 GF 12 70

HUGHES

FSCM NO. 05869

☒ **ENGINEERING ORDER**
☐ **DOCUMENT CHANGE NOTICE**

☐ CLASS I ☒ CLASS II ☐ COMPATIBILITY CLASS II ☐ RECORD CORRECTION

CHANGE IDENT NO.	SHEET
75393	1 OF 1

TITLE DELAY LINE SUBASSEMBLY, SAW CENTER FREQ 100 MHZ, BANDWIDTH 10MHZ	PROJECT RAYTHEON / SAW	ECP/UPN, ETC.	DRAWING NO. 1950525	REV. -	NO. 1

EFFECTIVITY: ☒ MANDATORY ☐ MANUFACTURING CONVENIENCE ☐ MANUFACTURING OPTION

	ORG CODE	DATE		ORG CODE	DATE
PREPARED BY RD YOVAN	12-67-10	77-12-12	APPROVED J. Lenigro	12-67-10	77-12-12
CHECKED BY W. Voigt 3 ✓CE	12-66-42	77-12-12			
PL MAINTENANCE					

CONTROL ITEM DRAWING NO.	FROM	THRU	CONFIGURATION ITEM DRAWING NO.	FROM	THRU
1950524 -100	1	UP			

DISPOSITION OF ITEMS: ☐ ITEMS CONFORM ☐ USE ☐ REWORK AS FOLLOWS: SEE REWORK INSTRUCTIONS

REASON AND DESCRIPTION – SEE BELOW FOR P/L CHANGES

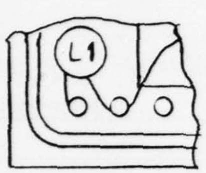
REASON: CLIPPED HEADER PINS NOT REQUIRED ON SAW DEVICE

IN G/N:

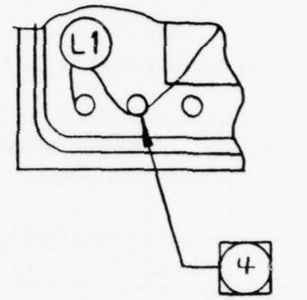
IS	WAS
4. NOT USED	4. CLIP INDICATED PIN FLUSH WITH FAR SIDE OF HEADER

ON F/D:

IS



WAS



STANDARD GSG RELEASE GSG

ITEM NO.	LINE NO.	ADD	DELETE	QTY REQ.	UNIT OF MEAS	MFG CODE IDENT NO.	PART OR IDENT NUMBER	DESCRIPTION	SPECIFICATION OR REFERENCE	FROM REF. DESIGNATION	THRU	WEIGHT IN LBS.	P/L NOTE	ZONE

4775 GS 5/76

HUGHES FSCM NO. 05869

☒ **ENGINEERING ORDER**
☐ **DOCUMENT CHANGE NOTICE**

☐ CLASS I ☒ CLASS II ☐ COMPATIBILITY CLASS II ☐ RECORD CORRECTION

CHANGE IDENT NO.	SHEET	OF
77388	1	1

TITLE	PROJECT	ECP/UPN, ETC.	DRAWING NO.	REV.	NO.
DELAY LINE SUBASSEMBLY SAW CENTER FREQUENCY 100 MHz, BANDWIDTH 10 MHz	SAW MMT		1950525	-	2

TYPE OF CHANGE: ☒ MANDATORY ☐ MANUFACTURING CONVENIENCE ☐ MANUFACTURING OPTION

	ORG CODE	DATE
PREPARED BY: L. DYAL	12-67-11	73-2-8
CHECKED BY: W. Voigt 3/ CE	12-66-42	78-02 08
APPROVED: [illegible]	12-17-11	73-2-3
PL MAINTENANCE		

CONTROL ITEM DRAWING NO.	CONTROL ITEM EFFECTIVITY	CONFIGURATION ITEM DRAWING NO.	CONFIGURATION ITEM EFFECTIVITY
1950524-100	1 - UP		

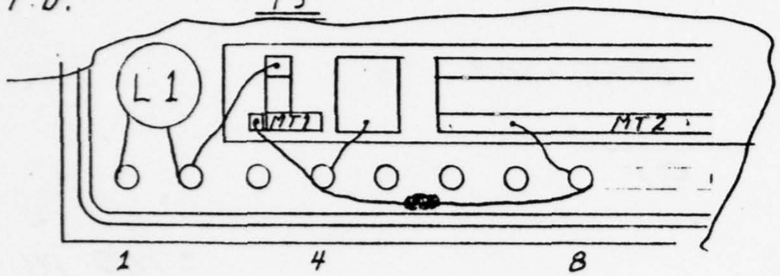
DISPOSITION OF ITEMS: ☐ ITEMS CONFORM ☐ USE ☐ REWORK AS FOLLOWS: SEE REWORK INSTRUCTIONS

REASON AND DESCRIPTION – SEE BELOW FOR P/L CHANGES

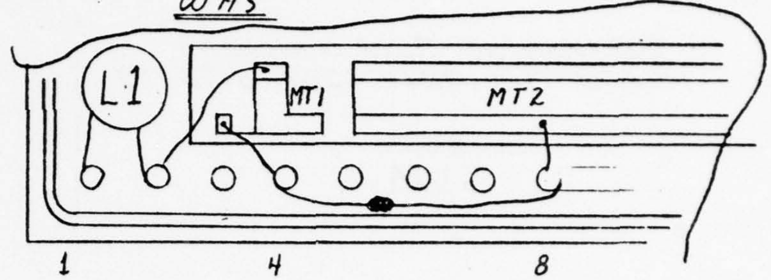
REASON: GROUND PAD AND INTERCONNECT NOT SHOWN ON FACE OF DRAWING

ON F.D.

IS



WAS



STANDARD
GSG **GSG**
RELEASE

ITEM NO.	LINE NO.	ADD	DELETE	QTY REQ.	UNIT OF MEAS	MFG CODE IDENT NO.	PART OR IDENT NUMBER	DESCRIPTION	SPECIFICATION OR REFERENCE	FROM REF. DESIGNATION	THRU REF. DESIGNATION	WEIGHT IN LBS.	P/L NOTE	ZONE

4775 CS 1/77

1950526 | 5

REVISIONS				
AUTHORITY	LTR	DESCRIPTION	DATE	APPROVED
DDT 82255	-	PRODUCTION RELEASE	7-	

NOTES:

1. MATERIAL: QUARTZ PER 760781-100
2. FABRICATE PER 780294-1.
3. DEPOSITION THICKNESS:
   0.125 ±0.01 μm
   (1250 ±100 Å)
4. INDICATES DIRECTION OF SPECIFIED CRYSTALLINE AXIS & PROPAGATION DIRECTION.
5. HORIZONTAL CENTERLINES OF MT1 & MT2 SHALL BE CO-LINEAR WITHIN AND PARALLEL TO X-AXIS WITHIN 0.25°.
6. IN DIMENSIONAL LISTINGS, THE NO. FOLLOWING THE LETTER E INDICATES THE POWER OF 10 BY WHICH THE NO. MUST BE MULTIPLIED TO OBTAIN THE CORRECT VALUE. FOR EXAMPLE:
   1.45870E-02 = 1.45870×10^{-2} = 0.014587
   1.34567E 00 = 1.34567×10^{0} = 1.34567
7. DEPOSITION FILM APPLIED IN INDICATED AREA.
8. INDICATED SURFACE TO BE CORRUGATED PER P82

FRAGILE ITEM (EASILY DAMAGED BY HANDLING) - TO BE INSTALLED IN NEXT ASSEMBLY AT POINT OF MANUFACTURE.

METRIC

THIRD ANGLE (AMERICAN) PROJECTION

1950525	SAW/MMT
NEXT ASSY	USED ON
APPLICATION	

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN MILLIMETERS & PER ANSI Y14.5

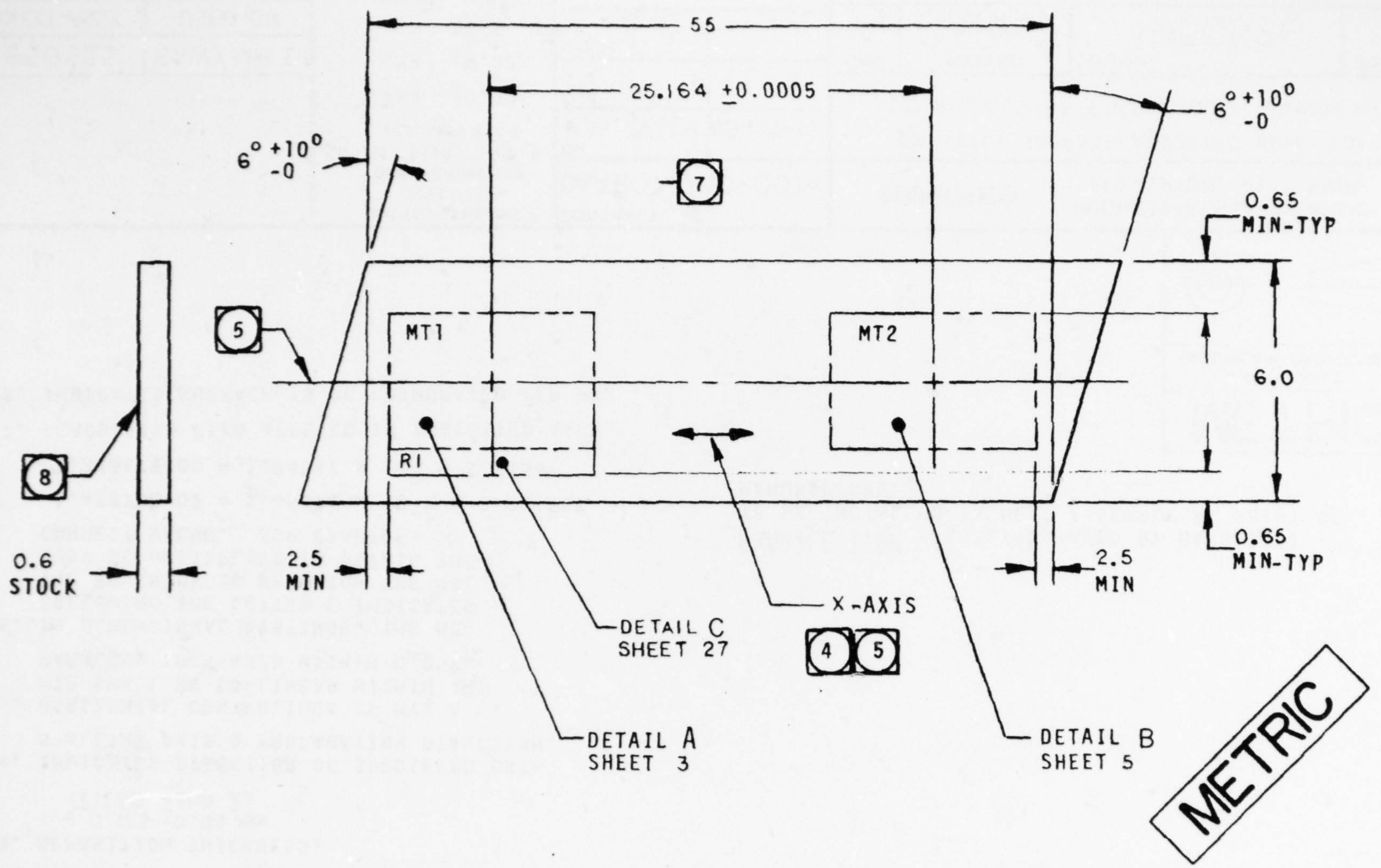
.XXX	±0.002
.XX	±0.02
.X	±0.5
ANGLES	±2°

CONTRACT: DAAB07-75C-0074	
DR K.S. KELLY	78-05-17
CHK	
APPD [signature]	7-

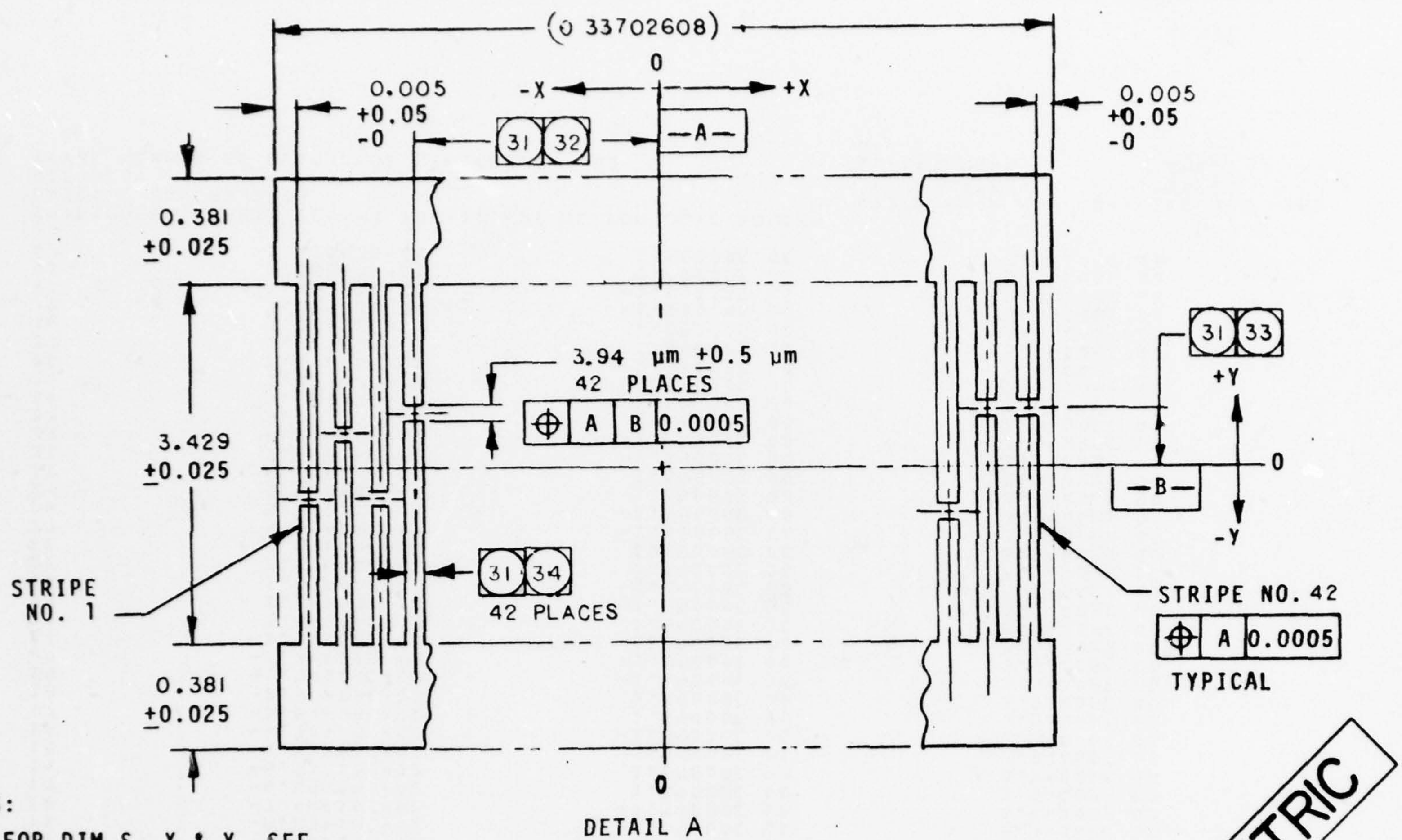
HUGHES — HUGHES AIRCRAFT COMPANY, FULLERTON, CALIFORNIA

CRYSTAL, SURFACE ACOUSTIC WAVE - TDL-100
100 MHz CENTER FREQ., 10 MHz BANDWITH

SIZE	FSCM NO.	DWG NO.	REV
A	05869	1950526	
SCALE NONE	WT	SHEET 1 OF 27	



HUGHES AIRCRAFT COMPANY FULLERTON, CALIFORNIA	CONTRACT: DAAB07-75C-0074			
DR K. S. KELLY	SIZE A	FSCM NO. 05869	DWG NO. 1950526	REV
ISSUED	SCALE NONE		SHEET 2	



DETAIL A

METRIC

NOTES:

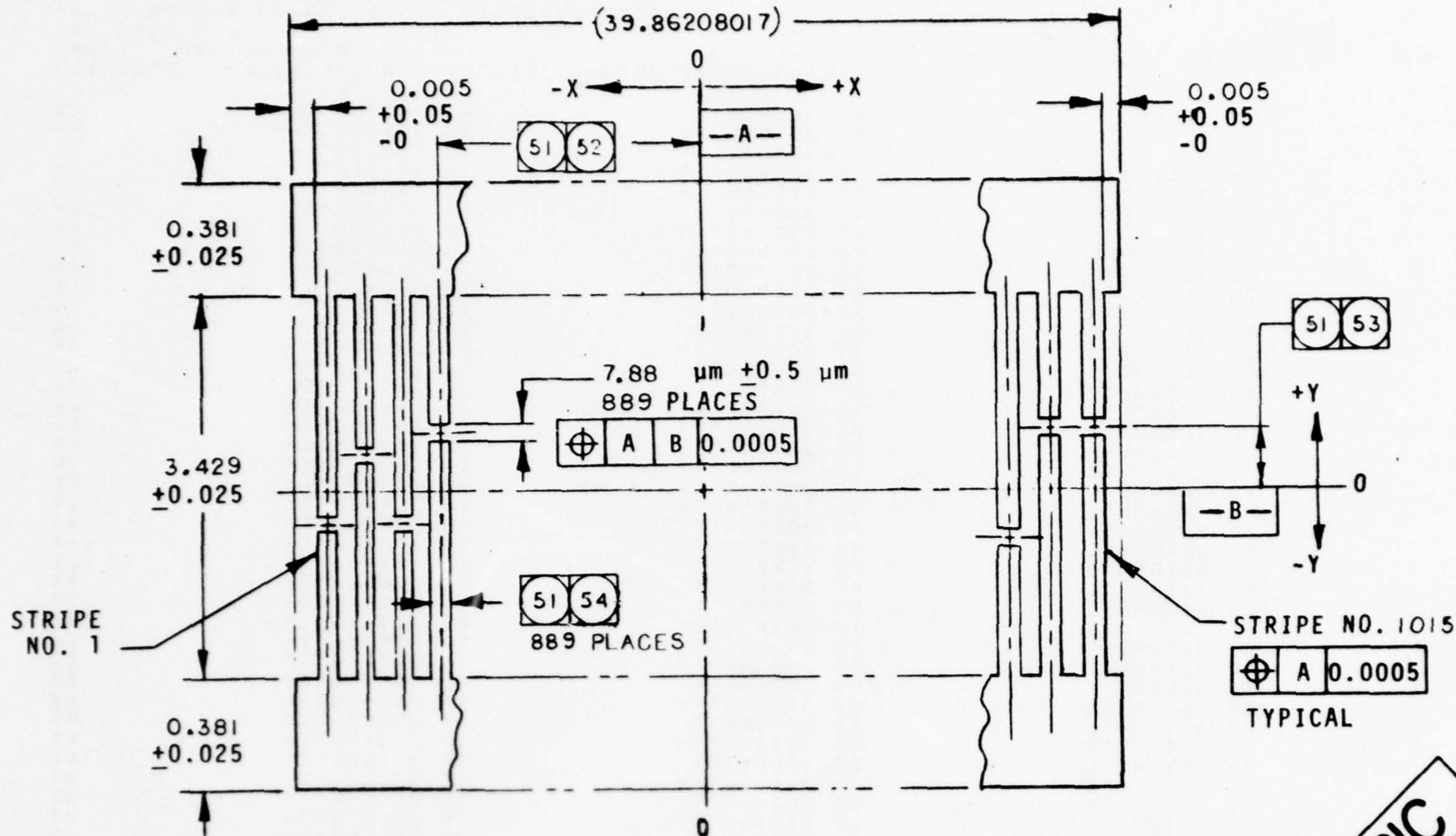
31. FOR DIM S, X, & Y, SEE SHEET 4.
32. DIM X ARE BASIC DIM TO CENTERLINES OF STRIPES.
33. DIM Y ARE BASIC DIM TO CENTERLINES OF STRIPE BREAKS.
34. TOLERANCE: ±0.1 μm PER μm.

HUGHES AIRCRAFT COMPANY FULLERTON, CALIFORNIA	CONTRACT: DAAB07-75C-0074			
	SIZE: A	FSCM NO.: 05869	DWG NO.: 1950526	REV
DR K.S. KELLY				
ISSUED	SCALE NONE		SHEET 3	

STRIPE NO.	DIM X STRIPE LOCATION	DIM Y BREAK LOCATION	DIM S STRIPE WIDTH
1	-1.61543E-01	1.59000E 00	3.94008E 00
2	-1.53663E-01	1.59000E 00	3.94008E 00
3	-1.45783E-01	-1.59000E 00	3.94008E 00
4	-1.37903E-01	-1.59000E 00	3.94008E 00
5	-1.30023E-01	1.59000E 00	3.94008E 00
6	-1.22143E-01	1.59000E 00	3.94008E 00
7	-1.14262E-01	-1.59000E 00	3.94008E 00
8	-1.06382E-01	-1.59000E 00	3.94008E 00
9	-9.85021E-02	1.59000E 00	3.94008E 00
10	-9.06219E-02	1.59000E 00	3.94008E 00
11	-8.27418E-02	-1.59000E 00	3.94008E 00
12	-7.48616E-02	-1.59000E 00	3.94008E 00
13	-6.69814E-02	1.59000E 00	3.94008E 00
14	-5.91013E-02	1.59000E 00	3.94008E 00
15	-5.12211E-02	-1.59000E 00	3.94008E 00
16	-4.33409E-02	-1.59000E 00	3.94008E 00
17	-3.54608E-02	1.59000E 00	3.94008E 00
18	-2.75806E-02	1.59000E 00	3.94008E 00
19	-1.97004E-02	-1.59000E 00	3.94008E 00
20	-1.18203E-02	-1.59000E 00	3.94008E 00
21	-3.94008E-03	1.59000E 00	3.94008E 00
22	3.94008E-03	1.59000E 00	3.94008E 00
23	1.18203E-02	-1.59000E 00	3.94008E 00
24	1.97004E-02	-1.59000E 00	3.94008E 00
25	2.75806E-02	1.59000E 00	3.94008E 00
26	3.54608E-02	1.59000E 00	3.94008E 00
27	4.33409E-02	-1.59000E 00	3.94008E 00
28	5.12211E-02	-1.59000E 00	3.94008E 00
29	5.91013E-02	1.59000E 00	3.94008E 00
30	6.69814E-02	1.59000E 00	3.94008E 00
31	7.48616E-02	-1.59000E 00	3.94008E 00
32	8.27418E-02	-1.59000E 00	3.94008E 00
33	9.06219E-02	1.59000E 00	3.94008E 00
34	9.85021E-02	1.59000E 00	3.94008E 00
35	1.06382E-01	-1.59000E 00	3.94008E 00
36	1.14262E-01	-1.59000E 00	3.94008E 00
37	1.22143E-01	1.59000E 00	3.94008E 00
38	1.30023E-01	1.59000E 00	3.94008E 00
39	1.37903E-01	-1.59000E 00	3.94008E 00
40	1.45783E-01	-1.59000E 00	3.94008E 00
41	1.53663E-01	1.59000E 00	3.94008E 00
42	1.61543E-01	1.59000E 00	3.94008E 00

TRANSDUCER NAME: ECOMMT TDL-100,21 DE PERIODIC XDUCER
DATE: JAN 23,1978
REF DES: MT1
TOTAL NUMBER OF ELECTRODE STRIPES: 42

SIZE	FSCM NO.	DRAWING NO.	REV
A	05869	1950526	
SCALE: NONE		SHEET	4



DETAIL B

NOTES:

(51) FOR DIM S, X, & Y, SEE SHEETS

(52) DIM X ARE BASIC DIM TO CENTERLINES OF STRIPES.

(53) DIM Y ARE BASIC DIM TO CENTERLINES OF STRIPE BREAKS.

(54) TOLERANCE: ±0.1 μm PER μm.

55. STRIPES WHOSE "DIM S" IS LISTED AS 0.0 ON SHEETS 6-26 ARE OMITTED SO THAT THERE ARE ACTUALLY 889 STRIPES ALTHOUGH NUMBERS RUN UP TO 1015.

METRIC

HUGHES AIRCRAFT COMPANY FULLERTON, CALIFORNIA	CONTRACT: DAAB07-75C-0074			
DR K. S. KELLY	SIZE A	FSCM NO. 05869	DWG NO. 1950526	REV
ISSUED	SCALE NONE		SHEET 5	

STRIPE NO.	DIM X STRIPE LOCATION	DIM Y BREAK LOCATION	DIM S STRIPE WIDTH
1	-1.99221E 01	1.59000E 00	7.88017E 00
2	-1.99063E 01	-1.59000E 00	7.88017E 00
3	-1.98906E 01	1.59000E 00	7.88017E 00
4	-1.98748E 01	-1.59000E 00	7.88017E 00
5	-1.98590E 01	1.59000E 00	7.88017E 00
6	-1.98433E 01	-1.59000E 00	7.88017E 00
7	-1.98275E 01	1.59000E 00	7.88017E 00
8	-1.97171E 01	-2.06968E-41	0.0
9	-1.96066E 01	1.59000E 00	7.88017E 00
10	-1.95909E 01	-1.59000E 00	7.88017E 00
11	-1.95751E 01	1.59000E 00	7.88017E 00
12	-1.95593E 01	-1.59000E 00	7.88017E 00
13	-1.95436E 01	1.59000E 00	7.88017E 00
14	-1.95278E 01	-1.59000E 00	7.88017E 00
15	-1.95121E 01	1.59000E 00	7.88017E 00
16	-1.94016E 01	-2.06968E-41	0.0
17	-1.92911E 01	1.59000E 00	7.88017E 00
18	-1.92754E 01	-1.59000E 00	7.88017E 00
19	-1.92596E 01	1.59000E 00	7.88017E 00
20	-1.92439E 01	-1.59000E 00	7.88017E 00
21	-1.92281E 01	1.59000E 00	7.88017E 00
22	-1.92123E 01	-1.59000E 00	7.88017E 00
23	-1.91966E 01	1.59000E 00	7.88017E 00
24	-1.90861E 01	-2.06968E-41	0.0
25	-1.89757E 01	1.59000E 00	7.88017E 00
26	-1.89599E 01	-1.59000E 00	7.88017E 00
27	-1.89441E 01	1.59000E 00	7.88017E 00
28	-1.89284E 01	-1.59000E 00	7.88017E 00
29	-1.89126E 01	1.59000E 00	7.88017E 00
30	-1.88969E 01	-1.59000E 00	7.88017E 00
31	-1.88811E 01	1.59000E 00	7.88017E 00
32	-1.87706E 01	-2.06968E-41	0.0
33	-1.86602E 01	1.59000E 00	7.88017E 00
34	-1.86444E 01	-1.59000E 00	7.88017E 00
35	-1.86287E 01	1.59000E 00	7.88017E 00
36	-1.86129E 01	-1.59000E 00	7.88017E 00
37	-1.85972E 01	1.59000E 00	7.88017E 00
38	-1.85814E 01	-1.59000E 00	7.88017E 00
39	-1.85656E 01	1.59000E 00	7.88017E 00
40	-1.84552E 01	-2.06968E-41	0.0
41	-1.83447E 01	1.59000E 00	7.88017E 00
42	-1.83290E 01	-1.59000E 00	7.88017E 00
43	-1.83132E 01	1.59000E 00	7.88017E 00
44	-1.82974E 01	-1.59000E 00	7.88017E 00
45	-1.82817E 01	1.59000E 00	7.88017E 00
46	-1.82659E 01	-1.59000E 00	7.88017E 00
47	-1.82502E 01	1.59000E 00	7.88017E 00
48	-1.81397E 01	-2.06968E-41	0.0
49	-1.80293E 01	-1.59000E 00	7.88017E 00
50	-1.80135E 01	1.59000E 00	7.88017E 00

TRANSDUCER NAME: ECOMMT TDL-100 TAPPED TRANSDUCER
DATE: JAN 23,1978
REF DES: MT2
TOTAL NUMBER OF ELECTRODE STRIPES: 1015

SIZE	FSCM NO.	DRAWING NO.	REV
A	05869	1950526	
SCALE: NONE		SHEET	6

STRIPE NO.	DIM X STRIPE LOCATION	DIM Y FREAK LOCATION	DIM S STRIPE WIDTH
51	-1.79977E 01	-1.59000E 00	7.88017E 00
52	-1.79820E 01	1.59000E 00	7.88017E 00
53	-1.79662E 01	-1.59000E 00	7.88017E 00
54	-1.79504E 01	1.59000E 00	7.88017E 00
55	-1.79347E 01	-1.59000E 00	7.88017E 00
56	-1.78242E 01	-2.06968E-41	0.0
57	-1.77138E 01	1.59000E 00	7.88017E 00
58	-1.76980E 01	-1.59000E 00	7.88017E 00
59	-1.76823E 01	1.59000E 00	7.88017E 00
60	-1.76665E 01	-1.59000E 00	7.88017E 00
61	-1.76507E 01	1.59000E 00	7.88017E 00
62	-1.76350E 01	-1.59000E 00	7.88017E 00
63	-1.76192E 01	1.59000E 00	7.88017E 00
64	-1.75088E 01	-2.06968E-41	0.0
65	-1.73983E 01	1.59000E 00	7.88017E 00
66	-1.73825E 01	-1.59000E 00	7.88017E 00
67	-1.73668E 01	1.59000E 00	7.88017E 00
68	-1.73510E 01	-1.59000E 00	7.88017E 00
69	-1.73353E 01	1.59000E 00	7.88017E 00
70	-1.73195E 01	-1.59000E 00	7.88017E 00
71	-1.73037E 01	1.59000E 00	7.88017E 00
72	-1.71933E 01	-2.06968E-41	0.0
73	-1.70828E 01	1.59000E 00	7.88017E 00
74	-1.70671E 01	-1.59000E 00	7.88017E 00
75	-1.70513E 01	1.59000E 00	7.88017E 00
76	-1.70356E 01	-1.59000E 00	7.88017E 00
77	-1.70198E 01	1.59000E 00	7.88017E 00
78	-1.70040E 01	-1.59000E 00	7.88017E 00
79	-1.69883E 01	1.59000E 00	7.88017E 00
80	-1.68778E 01	-2.06968E-41	0.0
81	-1.67673E 01	1.59000E 00	7.88017E 00
82	-1.67516E 01	-1.59000E 00	7.88017E 00
83	-1.67358E 01	1.59000E 00	7.88017E 00
84	-1.67201E 01	-1.59000E 00	7.88017E 00
85	-1.67043E 01	1.59000E 00	7.88017E 00
86	-1.66886E 01	-1.59000E 00	7.88017E 00
87	-1.66728E 01	1.59000E 00	7.88017E 00
88	-1.65623E 01	-2.06968E-41	0.0
89	-1.64519E 01	1.59000E 00	7.88017E 00
90	-1.64361E 01	-1.59000E 00	7.88017E 00
91	-1.64204E 01	1.59000E 00	7.88017E 00
92	-1.64046E 01	-1.59000E 00	7.88017E 00
93	-1.63888E 01	1.59000E 00	7.88017E 00
94	-1.63731E 01	-1.59000E 00	7.88017E 00
95	-1.63573E 01	1.59000E 00	7.88017E 00
96	-1.62469E 01	-2.06968E-41	0.0
97	-1.61364E 01	-1.59000E 00	7.88017E 00
98	-1.61207E 01	1.59000E 00	7.88017E 00
99	-1.61049E 01	-1.59000E 00	7.88017E 00
100	-1.60891E 01	1.59000E 00	7.88017E 00

TRANSDUCER NAME: ECOMMT TDL-100 TAPPED TRANSDUCER
DATE: JAN 23,1978
REF DES: MT2
TOTAL NUMBER OF ELECTRODE STRIPES: 1015

SIZE	FSCM NO.	DRAWING NO.	REV
A	05869	1950526	
SCALE: NONE		SHEET	7

STRIPE NO.	DIM X STRIPE LOCATION	DIM Y BREAK LOCATION	DIM S STRIPE WIDTH
101	-1.60734E 01	-1.59000E 00	7.88017E 00
102	-1.60576E 01	1.59000E 00	7.88017E 00
103	-1.60418E 01	-1.59000E 00	7.88017E 00
104	-1.59314E 01	-2.06968E-41	0.0
105	-1.58209E 01	-1.59000E 00	7.88017E 00
106	-1.58052E 01	1.59000E 00	7.88017E 00
107	-1.57894E 01	-1.59000E 00	7.88017E 00
108	-1.57737E 01	1.59000E 00	7.88017E 00
109	-1.57579E 01	-1.59000E 00	7.88017E 00
110	-1.57421E 01	1.59000E 00	7.88017E 00
111	-1.57264E 01	-1.59000E 00	7.88017E 00
112	-1.56159E 01	-2.06968E-41	0.0
113	-1.55055E 01	1.59000E 00	7.88017E 00
114	-1.54897E 01	-1.59000E 00	7.88017E 00
115	-1.54739E 01	1.59000E 00	7.88017E 00
116	-1.54582E 01	-1.59000E 00	7.88017E 00
117	-1.54424E 01	1.59000E 00	7.88017E 00
118	-1.54267E 01	-1.59000E 00	7.88017E 00
119	-1.54109E 01	1.59000E 00	7.88017E 00
120	-1.53005E 01	-2.06968E-41	0.0
121	-1.51900E 01	1.59000E 00	7.88017E 00
122	-1.51742E 01	-1.59000E 00	7.88017E 00
123	-1.51585E 01	1.59000E 00	7.88017E 00
124	-1.51427E 01	-1.59000E 00	7.88017E 00
125	-1.51270E 01	1.59000E 00	7.88017E 00
126	-1.51112E 01	-1.59000E 00	7.88017E 00
127	-1.50954E 01	1.59000E 00	7.88017E 00
128	-1.49850E 01	-2.06968E-41	0.0
129	-1.48745E 01	1.59000E 00	7.88017E 00
130	-1.48588E 01	-1.59000E 00	7.88017E 00
131	-1.48430E 01	1.59000E 00	7.88017E 00
132	-1.48272E 01	-1.59000E 00	7.88017E 00
133	-1.48115E 01	1.59000E 00	7.88017E 00
134	-1.47957E 01	-1.59000E 00	7.88017E 00
135	-1.47800E 01	1.59000E 00	7.88017E 00
136	-1.46695E 01	-2.06968E-41	0.0
137	-1.45590E 01	1.59000E 00	7.88017E 00
138	-1.45433E 01	-1.59000E 00	7.88017E 00
139	-1.45275E 01	1.59000E 00	7.88017E 00
140	-1.45118E 01	-1.59000E 00	7.88017E 00
141	-1.44960E 01	1.59000E 00	7.88017E 00
142	-1.44802E 01	-1.59000E 00	7.88017E 00
143	-1.44645E 01	1.59000E 00	7.88017E 00
144	-1.43540E 01	-2.06968E-41	0.0
145	-1.42436E 01	-1.59000E 00	7.88017E 00
146	-1.42278E 01	1.59000E 00	7.88017E 00
147	-1.42121E 01	-1.59000E 00	7.88017E 00
148	-1.41963E 01	1.59000E 00	7.88017E 00
149	-1.41805E 01	-1.59000E 00	7.88017E 00
150	-1.41648E 01	1.59000E 00	7.88017E 00

TRANSDUCER NAME: ECOMMT TDL-100 TAPPED TRANSDUCER
DATE: JAN 23,1978
REF DES: MT2
TOTAL NUMBER OF ELECTRODE STRIPES: 1015

SIZE	FSCM NO.	DRAWING NO.	REV
A	05869	1950526	
SCALE: NONE		SHEET	8

STRIPE NO.	DIM X STRIPE LOCATION	DIM Y BREAK LOCATION	DIM S STRIPE WIDTH
151	-1.41490E 01	-1.59000E 00	7.88017E 00
152	-1.40386E 01	-2.06968E-41	0.0
153	-1.39281E 01	1.59000E 00	7.88017E 00
154	-1.39123E 01	-1.59000E 00	7.88017E 00
155	-1.38966E 01	1.59000E 00	7.88017E 00
156	-1.38808E 01	-1.59000E 00	7.88017E 00
157	-1.38651E 01	1.59000E 00	7.88017E 00
158	-1.38493E 01	-1.59000E 00	7.88017E 00
159	-1.38335E 01	1.59000E 00	7.88017E 00
160	-1.37231E 01	-2.06968E-41	0.0
161	-1.36126E 01	-1.59000E 00	7.88017E 00
162	-1.35969E 01	1.59000E 00	7.88017E 00
163	-1.35811E 01	-1.59000E 00	7.88017E 00
164	-1.35653E 01	1.59000E 00	7.88017E 00
165	-1.35496E 01	-1.59000E 00	7.88017E 00
166	-1.35338E 01	1.59000E 00	7.88017E 00
167	-1.35181E 01	-1.59000E 00	7.88017E 00
168	-1.34076E 01	-2.06968E-41	0.0
169	-1.32972E 01	1.59000E 00	7.88017E 00
170	-1.32814E 01	-1.59000E 00	7.88017E 00
171	-1.32656E 01	1.59000E 00	7.88017E 00
172	-1.32499E 01	-1.59000E 00	7.88017E 00
173	-1.32341E 01	1.59000E 00	7.88017E 00
174	-1.32184E 01	-1.59000E 00	7.88017E 00
175	-1.32026E 01	1.59000E 00	7.88017E 00
176	-1.30921E 01	-2.06968E-41	0.0
177	-1.29817E 01	1.59000E 00	7.88017E 00
178	-1.29659E 01	-1.59000E 00	7.88017E 00
179	-1.29502E 01	1.59000E 00	7.88017E 00
180	-1.29344E 01	-1.59000E 00	7.88017E 00
181	-1.29186E 01	1.59000E 00	7.88017E 00
182	-1.29029E 01	-1.59000E 00	7.88017E 00
183	-1.28871E 01	1.59000E 00	7.88017E 00
184	-1.27767E 01	-2.06968E-41	0.0
185	-1.26662E 01	1.59000E 00	7.88017E 00
186	-1.26504E 01	-1.59000E 00	7.88017E 00
187	-1.26347E 01	1.59000E 00	7.88017E 00
188	-1.26189E 01	-1.59000E 00	7.88017E 00
189	-1.26032E 01	1.59000E 00	7.88017E 00
190	-1.25874E 01	-1.59000E 00	7.88017E 00
191	-1.25716E 01	1.59000E 00	7.88017E 00
192	-1.24612E 01	-2.06968E-41	0.0
193	-1.23507E 01	-1.59000E 00	7.88017E 00
194	-1.23350E 01	1.59000E 00	7.88017E 00
195	-1.23192E 01	-1.59000E 00	7.88017E 00
196	-1.23035E 01	1.59000E 00	7.88017E 00
197	-1.22877E 01	-1.59000E 00	7.88017E 00
198	-1.22719E 01	1.59000E 00	7.88017E 00
199	-1.22562E 01	-1.59000E 00	7.88017E 00
200	-1.21457E 01	-2.06968E-41	0.0

TRANSDUCER NAME: ECOMMT TDL-100 TAPPED TRANSDUCER
DATE: JAN 23,1978
REF DES: MT2
TOTAL NUMBER OF ELECTRODE STRIPES: 1015

SIZE	FSCM NO.	DRAWING NO.	REV
A	05869	1950526	
SCALE: NONE		SHEET	9

STRIPE NO.	DIM X STRIPE LOCATION	DIM Y BREAK LOCATION	DIM S STRIPE WIDTH
201	-1.20353E 01	-1.59000E 00	7.88017E 00
202	-1.20195E 01	1.59000E 00	7.88017E 00
203	-1.20037E 01	-1.59000E 00	7.88017E 00
204	-1.19880E 01	1.59000E 00	7.88017E 00
205	-1.19722E 01	-1.59000E 00	7.88017E 00
206	-1.19565E 01	1.59000E 00	7.88017E 00
207	-1.19407E 01	-1.59000E 00	7.88017E 00
208	-1.18302E 01	-2.06968E-41	0.0
209	-1.17198E 01	-1.59000E 00	7.88017E 00
210	-1.17040E 01	1.59000E 00	7.88017E 00
211	-1.16883E 01	-1.59000E 00	7.88017E 00
212	-1.16725E 01	1.59000E 00	7.88017E 00
213	-1.16567E 01	-1.59000E 00	7.88017E 00
214	-1.16410E 01	1.59000E 00	7.88017E 00
215	-1.16252E 01	-1.59000E 00	7.88017E 00
216	-1.15146E 01	-2.06968E-41	0.0
217	-1.14043E 01	-1.59000E 00	7.88017E 00
218	-1.13886E 01	1.59000E 00	7.88017E 00
219	-1.13728E 01	-1.59000E 00	7.88017E 00
220	-1.13570E 01	1.59000E 00	7.88017E 00
221	-1.13413E 01	-1.59000E 00	7.88017E 00
222	-1.13255E 01	1.59000E 00	7.88017E 00
223	-1.13098E 01	-1.59000E 00	7.88017E 00
224	-1.11993E 01	-2.06968E-41	0.0
225	-1.10888E 01	1.59000E 00	7.88017E 00
226	-1.10731E 01	-1.59000E 00	7.88017E 00
227	-1.10573E 01	1.59000E 00	7.88017E 00
228	-1.10416E 01	-1.59000E 00	7.88017E 00
229	-1.10258E 01	1.59000E 00	7.88017E 00
230	-1.10100E 01	-1.59000E 00	7.88017E 00
231	-1.09943E 01	1.59000E 00	7.88017E 00
232	-1.08838E 01	-2.06968E-41	0.0
233	-1.07734E 01	1.59000E 00	7.88017E 00
234	-1.07576E 01	-1.59000E 00	7.88017E 00
235	-1.07418E 01	1.59000E 00	7.88017E 00
236	-1.07261E 01	-1.59000E 00	7.88017E 00
237	-1.07103E 01	1.59000E 00	7.88017E 00
238	-1.06946E 01	-1.59000E 00	7.88017E 00
239	-1.06788E 01	1.59000E 00	7.88017E 00
240	-1.05684E 01	-2.06968E-41	0.0
241	-1.04579E 01	-1.59000E 00	7.88017E 00
242	-1.04421E 01	1.59000E 00	7.88017E 00
243	-1.04264E 01	-1.59000E 00	7.88017E 00
244	-1.04106E 01	1.59000E 00	7.88017E 00
245	-1.03949E 01	-1.59000E 00	7.88017E 00
246	-1.03791E 01	1.59000E 00	7.88017E 00
247	-1.03633E 01	-1.59000E 00	7.88017E 00
248	-1.02529E 01	-2.06968E-41	0.0
249	-1.01424E 01	1.59000E 00	7.88017E 00
250	-1.01267E 01	-1.59000E 00	7.88017E 00

TRANSDUCER NAME: ECOMMT TDL-100 TAPPED TRANSDUCER
DATE: JAN 23,1978
REF DES: MT2
TOTAL NUMBER OF ELECTRODE STRIPES: 1015

SIZE	FSCM NO.	DRAWING NO.	REV
A	05869	1950526	
SCALE: NONE		SHEET	10

STRIPE NO.	DIM X STRIPE LOCATION	DIM Y BREAK LOCATION	DIM S STRIPE WIDTH
251	-1.01109E 01	1.59000E 00	7.88017E 00
252	-1.00951E 01	-1.59000E 00	7.88017E 00
253	-1.00794E 01	1.59000E 00	7.88017E 00
254	-1.00636E 01	-1.59000E 00	7.88017E 00
255	-1.00479E 01	1.59000E 00	7.88017E 00
256	-9.93741E 00	-2.06968E-41	0.0
257	-9.82695E 00	1.59000E 00	7.88017E 00
258	-9.81119E 00	-1.59000E 00	7.88017E 00
259	-9.79543E 00	1.59000E 00	7.88017E 00
260	-9.77967E 00	-1.59000E 00	7.88017E 00
261	-9.76391E 00	1.59000E 00	7.88017E 00
262	-9.74815E 00	-1.59000E 00	7.88017E 00
263	-9.73239E 00	1.59000E 00	7.88017E 00
264	-9.62193E 00	-2.06968E-41	0.0
265	-9.51148E 00	1.59000E 00	7.88017E 00
266	-9.49572E 00	-1.59000E 00	7.88017E 00
267	-9.47996E 00	1.59000E 00	7.88017E 00
268	-9.46420E 00	-1.59000E 00	7.88017E 00
269	-9.44844E 00	1.59000E 00	7.88017E 00
270	-9.43268E 00	-1.59000E 00	7.88017E 00
271	-9.41691E 00	1.59000E 00	7.88017E 00
272	-9.30646E 00	-2.06968E-41	0.0
273	-9.19600E 00	-1.59000E 00	7.88017E 00
274	-9.18024E 00	1.59000E 00	7.88017E 00
275	-9.16448E 00	-1.59000E 00	7.88017E 00
276	-9.14872E 00	1.59000E 00	7.88017E 00
277	-9.13296E 00	-1.59000E 00	7.88017E 00
278	-9.11720E 00	1.59000E 00	7.88017E 00
279	-9.10144E 00	-1.59000E 00	7.88017E 00
280	-8.99099E 00	-2.06968E-41	0.0
281	-8.88053E 00	1.59000E 00	7.88017E 00
282	-8.86477E 00	-1.59000E 00	7.88017E 00
283	-8.84901E 00	1.59000E 00	7.88017E 00
284	-8.83325E 00	-1.59000E 00	7.88017E 00
285	-8.81749E 00	1.59000E 00	7.88017E 00
286	-8.80173E 00	-1.59000E 00	7.88017E 00
287	-8.78597E 00	1.59000E 00	7.88017E 00
288	-8.67551E 00	-2.06968E-41	0.0
289	-8.56506E 00	-1.59000E 00	7.88017E 00
290	-8.54930E 00	1.59000E 00	7.88017E 00
291	-8.53354E 00	-1.59000E 00	7.88017E 00
292	-8.51778E 00	1.59000E 00	7.88017E 00
293	-8.50202E 00	-1.59000E 00	7.88017E 00
294	-8.48626E 00	1.59000E 00	7.88017E 00
295	-8.47050E 00	-1.59000E 00	7.88017E 00
296	-8.36004E 00	-2.06968E-41	0.0
297	-8.24958E 00	-1.59000E 00	7.88017E 00
298	-8.23382E 00	1.59000E 00	7.88017E 00
299	-8.21806E 00	-1.59000E 00	7.88017E 00
300	-8.20230E 00	1.59000E 00	7.88017E 00

TRANSDUCER NAME: ECOMMT TDL-100 TAPPED TRANSDUCER
DATE: JAN 23,1978
REF DES: MT2
TOTAL NUMBER OF ELECTRODE STRIPES: 1015

SIZE	FSCM NO.	DRAWING NO.	REV
A	05869	1950526	
SCALE: NONE		SHEET	11

STRIPE NO.	DIM X STRIPE LOCATION	DIM Y BREAK LOCATION	DIM S STRIPE WIDTH
301	-8.18654E 00	-1.59000E 00	7.88017E 00
302	-8.17078E 00	1.59000E 00	7.88017E 00
303	-8.15502E 00	-1.59000E 00	7.88017E 00
304	-8.04457E 00	-2.06968E-41	0.0
305	-7.93411E 00	1.59000E 00	7.88017E 00
306	-7.91835E 00	-1.59000E 00	7.88017E 00
307	-7.90259E 00	1.59000E 00	7.88017E 00
308	-7.88683E 00	-1.59000E 00	7.88017E 00
309	-7.87107E 00	1.59000E 00	7.88017E 00
310	-7.85531E 00	-1.59000E 00	7.88017E 00
311	-7.83955E 00	1.59000E 00	7.88017E 00
312	-7.72909E 00	-2.06968E-41	0.0
313	-7.61864E 00	1.59000E 00	7.88017E 00
314	-7.60288E 00	-1.59000E 00	7.88017E 00
315	-7.58712E 00	1.59000E 00	7.88017E 00
316	-7.57136E 00	-1.59000E 00	7.88017E 00
317	-7.55560E 00	1.59000E 00	7.88017E 00
318	-7.53984E 00	-1.59000E 00	7.88017E 00
319	-7.52408E 00	1.59000E 00	7.88017E 00
320	-7.41362E 00	-2.06968E-41	0.0
321	-7.30316E 00	-1.59000E 00	7.88017E 00
322	-7.28740E 00	1.59000E 00	7.88017E 00
323	-7.27164E 00	-1.59000E 00	7.88017E 00
324	-7.25588E 00	1.59000E 00	7.88017E 00
325	-7.24012E 00	-1.59000E 00	7.88017E 00
326	-7.22436E 00	1.59000E 00	7.88017E 00
327	-7.20860E 00	-1.59000E 00	7.88017E 00
328	-7.09815E 00	-2.06968E-41	0.0
329	-6.98769E 00	-1.59000E 00	7.88017E 00
330	-6.97193E 00	1.59000E 00	7.88017E 00
331	-6.95617E 00	-1.59000E 00	7.88017E 00
332	-6.94041E 00	1.59000E 00	7.88017E 00
333	-6.92465E 00	-1.59000E 00	7.88017E 00
334	-6.90889E 00	1.59000E 00	7.88017E 00
335	-6.89313E 00	-1.59000E 00	7.88017E 00
336	-6.78267E 00	-2.06968E-41	0.0
337	-6.67222E 00	-1.59000E 00	7.88017E 00
338	-6.65646E 00	1.59000E 00	7.88017E 00
339	-6.64070E 00	-1.59000E 00	7.88017E 00
340	-6.62494E 00	1.59000E 00	7.88017E 00
341	-6.60918E 00	-1.59000E 00	7.88017E 00
342	-6.59342E 00	1.59000E 00	7.88017E 00
343	-6.57766E 00	-1.59000E 00	7.88017E 00
344	-6.46720E 00	-2.06968E-41	0.0
345	-6.35674E 00	1.59000E 00	7.88017E 00
346	-6.34098E 00	-1.59000E 00	7.88017E 00
347	-6.32522E 00	1.59000E 00	7.88017E 00
348	-6.30946E 00	-1.59000E 00	7.88017E 00
349	-6.29370E 00	1.59000E 00	7.88017E 00
350	-6.27794E 00	-1.59000E 00	7.88017E 00

TRANSDUCER NAME: ECOMMT TEL-100 TAPPED TRANSDUCER
DATE: JAN 23,1978
REF DES: MT2
TOTAL NUMBER OF ELECTRODE STRIPES: 1015

SIZE A FSCM NO. 05869 DRAWING NO. 1950526 REV
SCALE: NONE SHEET 12

STRIPE NO.	DIM X STRIPE LOCATION	DIM Y BREAK LOCATION	DIM S STRIPE WIDTH
351	-6.26218E 00	1.59000E 00	7.88017E 00
352	-6.15173E 00	-2.06968E-41	0.0
353	-6.04127E 00	-1.59000E 00	7.88017E 00
354	-6.02551E 00	1.59000E 00	7.88017E 00
355	-6.00975E 00	-1.59000E 00	7.88017E 00
356	-5.99399E 00	1.59000E 00	7.88017E 00
357	-5.97823E 00	-1.59000E 00	7.88017E 00
358	-5.96247E 00	1.59000E 00	7.88017E 00
359	-5.94671E 00	-1.59000E 00	7.88017E 00
360	-5.83625E 00	-2.06968E-41	0.0
361	-5.72580E 00	1.59000E 00	7.88017E 00
362	-5.71004E 00	-1.59000E 00	7.88017E 00
363	-5.69428E 00	1.59000E 00	7.88017E 00
364	-5.67852E 00	-1.59000E 00	7.88017E 00
365	-5.66276E 00	1.59000E 00	7.88017E 00
366	-5.64700E 00	-1.59000E 00	7.88017E 00
367	-5.63124E 00	1.59000E 00	7.88017E 00
368	-5.52078E 00	-2.06968E-41	0.0
369	-5.41033E 00	-1.59000E 00	7.88017E 00
370	-5.39456E 00	1.59000E 00	7.88017E 00
371	-5.37880E 00	-1.59000E 00	7.88017E 00
372	-5.36304E 00	1.59000E 00	7.88017E 00
373	-5.34728E 00	-1.59000E 00	7.88017E 00
374	-5.33152E 00	1.59000E 00	7.88017E 00
375	-5.31576E 00	-1.59000E 00	7.88017E 00
376	-5.20531E 00	-2.06968E-41	0.0
377	-5.09485E 00	1.59000E 00	7.88017E 00
378	-5.07909E 00	-1.59000E 00	7.88017E 00
379	-5.06333E 00	1.59000E 00	7.88017E 00
380	-5.04757E 00	-1.59000E 00	7.88017E 00
381	-5.03181E 00	1.59000E 00	7.88017E 00
382	-5.01605E 00	-1.59000E 00	7.88017E 00
383	-5.00029E 00	1.59000E 00	7.88017E 00
384	-4.88983E 00	-2.06968E-41	0.0
385	-4.77938E 00	1.59000E 00	7.88017E 00
386	-4.76362E 00	-1.59000E 00	7.88017E 00
387	-4.74786E 00	1.59000E 00	7.88017E 00
388	-4.73210E 00	-1.59000E 00	7.88017E 00
389	-4.71634E 00	1.59000E 00	7.88017E 00
390	-4.70058E 00	-1.59000E 00	7.88017E 00
391	-4.68482E 00	1.59000E 00	7.88017E 00
392	-4.57436E 00	-2.06968E-41	0.0
393	-4.46391E 00	-1.59000E 00	7.88017E 00
394	-4.44814E 00	1.59000E 00	7.88017E 00
395	-4.43238E 00	-1.59000E 00	7.88017E 00
396	-4.41662E 00	1.59000E 00	7.88017E 00
397	-4.40086E 00	-1.59000E 00	7.88017E 00
398	-4.38510E 00	1.59000E 00	7.88017E 00
399	-4.36934E 00	-1.59000E 00	7.88017E 00
400	-4.25889E 00	-2.06968E-41	0.0

TRANSDUCER NAME: ECOMMT TDL-100 TAPPED TRANSDUCER
DATE: JAN 23,1978
REF DFS: MT2
TOTAL NUMBER OF ELECTRODE STRIPES: 1015

SIZE	FSCM NO.	DRAWING NO.	REV
A	05869	1950526	
SCALE: NONE		SHEET	13

STRIPE NO.	DIM X STRIPE LOCATION	DIM Y BREAK LOCATION	DIM S STRIPE WIDTH
401	-4.14843E 00	-1.59000E 00	7.88017E 00
402	-4.13267E 00	1.59000E 00	7.88017E 00
403	-4.11691E 00	-1.59000E 00	7.88017E 00
404	-4.10115E 00	1.59000E 00	7.88017E 00
405	-4.08539E 00	-1.59000E 00	7.88017E 00
406	-4.06963E 00	1.59000E 00	7.88017E 00
407	-4.05387E 00	-1.59000E 00	7.88017E 00
408	-3.94341E 00	-2.06968E-41	0.0
409	-3.83296E 00	-1.59000E 00	7.88017E 00
410	-3.81720E 00	1.59000E 00	7.88017E 00
411	-3.80144E 00	-1.59000E 00	7.88017E 00
412	-3.78568E 00	1.59000E 00	7.88017E 00
413	-3.76992E 00	-1.59000E 00	7.88017E 00
414	-3.75416E 00	1.59000E 00	7.88017E 00
415	-3.73840E 00	-1.59000E 00	7.88017E 00
416	-3.62794E 00	-2.06968E-41	0.0
417	-3.51749E 00	-1.59000E 00	7.88017E 00
418	-3.50173E 00	1.59000E 00	7.88017E 00
419	-3.48596E 00	-1.59000E 00	7.88017E 00
420	-3.47020E 00	1.59000E 00	7.88017E 00
421	-3.45444E 00	-1.59000E 00	7.88017E 00
422	-3.43868E 00	1.59000E 00	7.88017E 00
423	-3.42292E 00	-1.59000E 00	7.88017E 00
424	-3.31247E 00	-2.06968E-41	0.0
425	-3.20201E 00	-1.59000E 00	7.88017E 00
426	-3.18625E 00	1.59000E 00	7.88017E 00
427	-3.17049E 00	-1.59000E 00	7.88017E 00
428	-3.15473E 00	1.59000E 00	7.88017E 00
429	-3.13897E 00	-1.59000E 00	7.88017E 00
430	-3.12321E 00	1.59000E 00	7.88017E 00
431	-3.10745E 00	-1.59000E 00	7.88017E 00
432	-2.99699E 00	-2.06968E-41	0.0
433	-2.88654E 00	1.59000E 00	7.88017E 00
434	-2.87078E 00	-1.59000E 00	7.88017E 00
435	-2.85502E 00	1.59000E 00	7.88017E 00
436	-2.83926E 00	-1.59000E 00	7.88017E 00
437	-2.82350E 00	1.59000E 00	7.88017E 00
438	-2.80774E 00	-1.59000E 00	7.88017E 00
439	-2.79198E 00	1.59000E 00	7.88017E 00
440	-2.68152E 00	-2.06968E-41	0.0
441	-2.57107E 00	-1.59000E 00	7.88017E 00
442	-2.55531E 00	1.59000E 00	7.88017E 00
443	-2.53955E 00	-1.59000E 00	7.88017E 00
444	-2.52379E 00	1.59000E 00	7.88017E 00
445	-2.50803E 00	-1.59000E 00	7.88017E 00
446	-2.49226E 00	1.59000E 00	7.88017E 00
447	-2.47650E 00	-1.59000E 00	7.88017E 00
448	-2.36605E 00	-2.06968E-41	0.0
449	-2.25559E 00	1.59000E 00	7.88017E 00
450	-2.23983E 00	-1.59000E 00	7.88017E 00

TRANSDUCER NAME: ECOMMT TDL-100 TAPPED TRANSDUCER
DATE: JAN 23,1978
REF DES: MT2
TOTAL NUMBER OF ELECTRODE STRIPES: 1015

SIZE	FSCM NO.	DRAWING NO.	REV
A	05869	1950526	
SCALE: NONE		SHEET	14

STRIPE NO.	DIM X STRIPE LOCATION	DIM Y BREAK LOCATION	DIM S STRIPE WIDTH
451	-2.22407E 00	1.59000E 00	7.88017E 00
452	-2.20831E 00	-1.59000E 00	7.88017E 00
453	-2.19255E 00	1.59000E 00	7.88017E 00
454	-2.17679E 00	-1.59000E 00	7.88017E 00
455	-2.16103E 00	1.59000E 00	7.88017E 00
456	-2.05058E 00	-2.06968E-41	0.0
457	-1.94012E 00	1.59000E 00	7.88017E 00
458	-1.92436E 00	-1.59000E 00	7.88017E 00
459	-1.90860E 00	1.59000E 00	7.88017E 00
460	-1.89284E 00	-1.59000E 00	7.88017E 00
461	-1.87708E 00	1.59000E 00	7.88017E 00
462	-1.86132E 00	-1.59000E 00	7.88017E 00
463	-1.84556E 00	1.59000E 00	7.88017E 00
464	-1.73510E 00	-2.06968E-41	0.0
465	-1.62465E 00	1.59000E 00	7.88017E 00
466	-1.60889E 00	-1.59000E 00	7.88017E 00
467	-1.59313E 00	1.59000E 00	7.88017E 00
468	-1.57737E 00	-1.59000E 00	7.88017E 00
469	-1.56161E 00	1.59000E 00	7.88017E 00
470	-1.54585E 00	-1.59000E 00	7.88017E 00
471	-1.53008E 00	1.59000E 00	7.88017E 00
472	-1.41963E 00	-2.06968E-41	0.0
473	-1.30917E 00	1.59000E 00	7.88017E 00
474	-1.29341E 00	-1.59000E 00	7.88017E 00
475	-1.27765E 00	1.59000E 00	7.88017E 00
476	-1.26189E 00	-1.59000E 00	7.88017E 00
477	-1.24613E 00	1.59000E 00	7.88017E 00
478	-1.23037E 00	-1.59000E 00	7.88017E 00
479	-1.21461E 00	1.59000E 00	7.88017E 00
480	-1.10416E 00	-2.06968E-41	0.0
481	-9.93701E-01	-1.59000E 00	7.88017E 00
482	-9.77940E-01	1.59000E 00	7.88017E 00
483	-9.62180E-01	-1.59000E 00	7.88017E 00
484	-9.46420E-01	1.59000E 00	7.88017E 00
485	-9.30659E-01	-1.59000E 00	7.88017E 00
486	-9.14899E-01	1.59000E 00	7.88017E 00
487	-8.99139E-01	-1.59000E 00	7.88017E 00
488	-7.88683E-01	-2.06968E-41	0.0
489	-6.78227E-01	-1.59000E 00	7.88017E 00
490	-6.62467E-01	1.59000E 00	7.88017E 00
491	-6.46707E-01	-1.59000E 00	7.88017E 00
492	-6.30946E-01	1.59000E 00	7.88017E 00
493	-6.15186E-01	-1.59000E 00	7.88017E 00
494	-5.99426E-01	1.59000E 00	7.88017E 00
495	-5.83665E-01	-1.59000E 00	7.88017E 00
496	-4.73210E-01	-2.06968E-41	0.0
497	-3.62754E-01	-1.59000E 00	7.88017E 00
498	-3.46994E-01	1.59000E 00	7.88017E 00
499	-3.31234E-01	-1.59000E 00	7.88017E 00
500	-3.15473E-01	1.59000E 00	7.88017E 00

TRANSDUCER NAME: ECOMMT TDL-100 TAPPED TRANSDUCER
DATE: JAN 23,1978
REF DES: MT2
TOTAL NUMBER OF ELECTRODE STRIPES: 1015

SIZE	FSCM NO.	DRAWING NO.	REV
A	05869	1950526	
SCALE: NONE		SHEET	15

STRIPE NO.	DIM X STRIPE LOCATION	DIM Y BREAK LOCATION	DIM S STRIPE WIDTH
501	-2.99713E-01	-1.59000E 00	7.88017E 00
502	-2.83952E-01	1.59000E 00	7.88017E 00
503	-2.68192E-01	-1.59000E 00	7.88017E 00
504	-1.57737E-01	-2.06968E-41	0.0
505	-4.72810E-02	1.59000E 00	7.88017E 00
506	-3.15207E-02	-1.59000E 00	7.88017E 00
507	-1.57603E-02	1.59000E 00	7.88017E 00
508	0.0	-1.59000E 00	7.88017E 00
509	1.57603E-02	1.59000E 00	7.88017E 00
510	3.15207E-02	-1.59000E 00	7.88017E 00
511	4.72810E-02	1.59000E 00	7.88017E 00
512	1.57737E-01	-2.06968E-41	0.0
513	2.68192E-01	1.59000E 00	7.88017E 00
514	2.83952E-01	-1.59000E 00	7.88017E 00
515	2.99713E-01	1.59000E 00	7.88017E 00
516	3.15473E-01	-1.59000E 00	7.88017E 00
517	3.31234E-01	1.59000E 00	7.88017E 00
518	3.46994E-01	-1.59000E 00	7.88017E 00
519	3.62754E-01	1.59000E 00	7.88017E 00
520	4.73210E-01	-2.06968E-41	0.0
521	5.83665E-01	1.59000E 00	7.88017E 00
522	5.99426E-01	-1.59000E 00	7.88017E 00
523	6.15186E-01	1.59000E 00	7.88017E 00
524	6.30946E-01	-1.59000E 00	7.88017E 00
525	6.46707E-01	1.59000E 00	7.88017E 00
526	6.62467E-01	-1.59000E 00	7.88017E 00
527	6.78227E-01	1.59000E 00	7.88017E 00
528	7.88683E-01	-2.06968E-41	0.0
529	8.99139E-01	-1.59000E 00	7.88017E 00
530	9.14899E-01	1.59000E 00	7.88017E 00
531	9.30659E-01	-1.59000E 00	7.88017E 00
532	9.46420E-01	1.59000E 00	7.88017E 00
533	9.62180E-01	-1.59000E 00	7.88017E 00
534	9.77940E-01	1.59000E 00	7.88017E 00
535	9.93701E-01	-1.59000E 00	7.88017E 00
536	1.10416E 00	-2.06968E-41	0.0
537	1.21461E 00	1.59000E 00	7.88017E 00
538	1.23037E 00	-1.59000E 00	7.88017E 00
539	1.24613E 00	1.59000E 00	7.88017E 00
540	1.26189E 00	-1.59000E 00	7.88017E 00
541	1.27765E 00	1.59000E 00	7.88017E 00
542	1.29341E 00	-1.59000E 00	7.88017E 00
543	1.30917E 00	1.59000E 00	7.88017E 00
544	1.41963E 00	-2.06968E-41	0.0
545	1.53008E 00	1.59000E 00	7.88017E 00
546	1.54585E 00	-1.59000E 00	7.88017E 00
547	1.56161E 00	1.59000E 00	7.88017E 00
548	1.57737E 00	-1.59000E 00	7.88017E 00
549	1.59313E 00	1.59000E 00	7.88017E 00
550	1.60889E 00	-1.59000E 00	7.88017E 00

TRANSDUCER NAME: ECOMMT TDL-100 TAPPED TRANSDUCER
DATE: JAN 23,1978
REF DES: MT2
TOTAL NUMBER OF ELECTRODE STRIPES: 1015

SIZE	FSCM NO.	DRAWING NO.	REV
A	05869	1950526	
SCALE: NONE		SHEET	16

STRIPE NO.	DIM X STRIPE LOCATION	DIM Y BREAK LOCATION	DIM S STRIPE WIDTH
551	1.62465E 00	1.59000E 00	7.88017E 00
552	1.73510E 00	-2.06968E-41	0.0
553	1.84556E 00	-1.59000E 00	7.88017E 00
554	1.86132E 00	1.59000E 00	7.88017E 00
555	1.87708E 00	-1.59000E 00	7.88017E 00
556	1.89284E 00	1.59000E 00	7.88017E 00
557	1.90860E 00	-1.59000E 00	7.88017E 00
558	1.92436E 00	1.59000E 00	7.88017E 00
559	1.94012E 00	-1.59000E 00	7.88017E 00
560	2.05058E 00	-2.06968E-41	0.0
561	2.16103E 00	1.59000E 00	7.88017E 00
562	2.17679E 00	-1.59000E 00	7.88017E 00
563	2.19255E 00	1.59000E 00	7.88017E 00
564	2.20831E 00	-1.59000E 00	7.88017E 00
565	2.22407E 00	1.59000E 00	7.88017E 00
566	2.23983E 00	-1.59000E 00	7.88017E 00
567	2.25559E 00	1.59000E 00	7.88017E 00
568	2.36605E 00	-2.06968E-41	0.0
569	2.47650E 00	1.59000E 00	7.88017E 00
570	2.49226E 00	-1.59000E 00	7.88017E 00
571	2.50803E 00	1.59000E 00	7.88017E 00
572	2.52379E 00	-1.59000E 00	7.88017E 00
573	2.53955E 00	1.59000E 00	7.88017E 00
574	2.55531E 00	-1.59000E 00	7.88017E 00
575	2.57107E 00	1.59000E 00	7.88017E 00
576	2.68152E 00	-2.06968E-41	0.0
577	2.79198E 00	-1.59000E 00	7.88017E 00
578	2.80774E 00	1.59000E 00	7.88017E 00
579	2.82350E 00	-1.59000E 00	7.88017E 00
580	2.83926E 00	1.59000E 00	7.88017E 00
581	2.85502E 00	-1.59000E 00	7.88017E 00
582	2.87078E 00	1.59000E 00	7.88017E 00
583	2.88654E 00	-1.59000E 00	7.88017E 00
584	2.99699E 00	-2.06968E-41	0.0
585	3.10745E 00	-1.59000E 00	7.88017E 00
586	3.12321E 00	1.59000E 00	7.88017E 00
587	3.13897E 00	-1.59000E 00	7.88017E 00
588	3.15473E 00	1.59000E 00	7.88017E 00
589	3.17049E 00	-1.59000E 00	7.88017E 00
590	3.18625E 00	1.59000E 00	7.88017E 00
591	3.20201E 00	-1.59000E 00	7.88017E 00
592	3.31247E 00	-2.06968E-41	0.0
593	3.42292E 00	1.59000E 00	7.88017E 00
594	3.43868E 00	-1.59000E 00	7.88017E 00
595	3.45444E 00	1.59000E 00	7.88017E 00
596	3.47020E 00	-1.59000E 00	7.88017E 00
597	3.48596E 00	1.59000E 00	7.88017E 00
598	3.50173E 00	-1.59000E 00	7.88017E 00
599	3.51749E 00	1.59000E 00	7.88017E 00
600	3.62794E 00	-2.06968E-41	0.0

TRANSDUCER NAME: ECOMMT TDL-100 TAPPED TRANSDUCER
DATE: JAN 23,1978
REF DES: MT2
TOTAL NUMBER OF ELECTRODE STRIPES: 1015

SIZE	FSCM NO.	DRAWING NO.	REV
A	05869	1950526	
SCALE: NONE		SHEET	17

STRIPE NO.	DIM X STRIPE LOCATION	DIM Y BREAK LOCATION	DIM S STRIPE WIDTH
601	3.73840E 00	-1.59000E 00	7.88017E 00
602	3.75416E 00	1.59000E 00	7.88017E 00
603	3.76992E 00	-1.59000E 00	7.88017E 00
604	3.78568E 00	1.59000E 00	7.88017E 00
605	3.80144E 00	-1.59000E 00	7.88017E 00
606	3.81720E 00	1.59000E 00	7.88017E 00
607	3.83296E 00	-1.59000E 00	7.88017E 00
608	3.94341E 00	-2.06968E-41	0.0
609	4.05387E 00	-1.59000E 00	7.88017E 00
610	4.06963E 00	1.59000E 00	7.88017E 00
611	4.08539E 00	-1.59000E 00	7.88017E 00
612	4.10115E 00	1.59000E 00	7.88017E 00
613	4.11691E 00	-1.59000E 00	7.88017E 00
614	4.13267E 00	1.59000E 00	7.88017E 00
615	4.14843E 00	-1.59000E 00	7.88017E 00
616	4.25889E 00	-2.06968E-41	0.0
617	4.36934E 00	1.59000E 00	7.88017E 00
618	4.38510E 00	-1.59000E 00	7.88017E 00
619	4.40086E 00	1.59000E 00	7.88017E 00
620	4.41662E 00	-1.59000E 00	7.88017E 00
621	4.43238E 00	1.59000E 00	7.88017E 00
622	4.44814E 00	-1.59000E 00	7.88017E 00
623	4.46391E 00	1.59000E 00	7.88017E 00
624	4.57436E 00	-2.06968E-41	0.0
625	4.68482E 00	-1.59000E 00	7.88017E 00
626	4.70058E 00	1.59000E 00	7.88017E 00
627	4.71634E 00	-1.59000E 00	7.88017E 00
628	4.73210E 00	1.59000E 00	7.88017E 00
629	4.74786E 00	-1.59000E 00	7.88017E 00
630	4.76362E 00	1.59000E 00	7.88017E 00
631	4.77938E 00	-1.59000E 00	7.88017E 00
632	4.88983E 00	-2.06968E-41	0.0
633	5.00029E 00	1.59000E 00	7.88017E 00
634	5.01605E 00	-1.59000E 00	7.88017E 00
635	5.03181E 00	1.59000E 00	7.88017E 00
636	5.04757E 00	-1.59000E 00	7.88017E 00
637	5.06333E 00	1.59000E 00	7.88017E 00
638	5.07909E 00	-1.59000E 00	7.88017E 00
639	5.09485E 00	1.59000E 00	7.88017E 00
640	5.20531E 00	-2.06968E-41	0.0
641	5.31576E 00	-1.59000E 00	7.88017E 00
642	5.33152E 00	1.59000E 00	7.88017E 00
643	5.34728E 00	-1.59000E 00	7.88017E 00
644	5.36304E 00	1.59000E 00	7.88017E 00
645	5.37880E 00	-1.59000E 00	7.88017E 00
646	5.39456E 00	1.59000E 00	7.88017E 00
647	5.41033E 00	-1.59000E 00	7.88017E 00
648	5.52078E 00	-2.06968E-41	0.0
649	5.63124E 00	-1.59000E 00	7.88017E 00
650	5.64700E 00	1.59000E 00	7.88017E 00

TRANSDUCER NAME: ECOMMT TDL-100 TAPPED TRANSDUCER
DATE: JAN 23,1978
REF DES: MT2
TOTAL NUMBER OF ELECTRODE STRIPES: 1015

SIZE	FSCM NO.	DRAWING NO.	REV
A	05869	1950526	
SCALE: NONE		SHEET	18

STRIPE NO.	DIM X STRIPE LOCATION	DIM Y BREAK LOCATION	DIM S STRIPE WIDTH
651	5.66276E 00	-1.59000E 00	7.88017E 00
652	5.67852E 00	1.59000E 00	7.88017E 00
653	5.69428E 00	-1.59000E 00	7.88017E 00
654	5.71004E 00	1.59000E 00	7.88017E 00
655	5.72580E 00	-1.59000E 00	7.88017E 00
656	5.83625E 00	-2.06968E-41	0.0
657	5.94671E 00	1.59000E 00	7.88017E 00
658	5.96247E 00	-1.59000E 00	7.88017E 00
659	5.97823E 00	1.59000E 00	7.88017E 00
660	5.99399E 00	-1.59000E 00	7.88017E 00
661	6.00975E 00	1.59000E 00	7.88017E 00
662	6.02551E 00	-1.59000E 00	7.88017E 00
663	6.04127E 00	1.59000E 00	7.88017E 00
664	6.15173E 00	-2.06968E-41	0.0
665	6.26218E 00	-1.59000E 00	7.88017E 00
666	6.27794E 00	1.59000E 00	7.88017E 00
667	6.29370E 00	-1.59000E 00	7.88017E 00
668	6.30946E 00	1.59000E 00	7.88017E 00
669	6.32522E 00	-1.59000E 00	7.88017E 00
670	6.34098E 00	1.59000E 00	7.88017E 00
671	6.35674E 00	-1.59000E 00	7.88017E 00
672	6.46720E 00	-2.06968E-41	0.0
673	6.57766E 00	-1.59000E 00	7.88017E 00
674	6.59342E 00	1.59000E 00	7.88017E 00
675	6.60918E 00	-1.59000E 00	7.88017E 00
676	6.62494E 00	1.59000E 00	7.88017E 00
677	6.64070E 00	-1.59000E 00	7.88017E 00
678	6.65646E 00	1.59000E 00	7.88017E 00
679	6.67222E 00	-1.59000E 00	7.88017E 00
680	6.78267E 00	-2.06968E-41	0.0
681	6.89313E 00	-1.59000E 00	7.88017E 00
682	6.90889E 00	1.59000E 00	7.88017E 00
683	6.92465E 00	-1.59000E 00	7.88017E 00
684	6.94041E 00	1.59000E 00	7.88017E 00
685	6.95617E 00	-1.59000E 00	7.88017E 00
686	6.97193E 00	1.59000E 00	7.88017E 00
687	6.98769E 00	-1.59000E 00	7.88017E 00
688	7.09815E 00	-2.06968E-41	0.0
689	7.20860E 00	-1.59000E 00	7.88017E 00
690	7.22436E 00	1.59000E 00	7.88017E 00
691	7.24012E 00	-1.59000E 00	7.88017E 00
692	7.25588E 00	1.59000E 00	7.88017E 00
693	7.27164E 00	-1.59000E 00	7.88017E 00
694	7.28740E 00	1.59000E 00	7.88017E 00
695	7.30316E 00	-1.59000E 00	7.88017E 00
696	7.41362E 00	-2.06968E-41	0.0
697	7.52408E 00	1.59000E 00	7.88017E 00
698	7.53984E 00	-1.59000E 00	7.88017E 00
699	7.55560E 00	1.59000E 00	7.88017E 00
700	7.57136E 00	-1.59000E 00	7.88017E 00

TRANSDUCER NAME: ECOMMT TDL-100 TAPPED TRANSDUCER
DATE: JAN 23,1978
REF DES: MT2
TOTAL NUMBER OF ELECTRODE STRIPES: 1015

SIZE	FSCM NO.	DRAWING NO.	REV
A	05869	1950526	
SCALE: NONE		SHEET	19

STRIPE NO.	DIM X STRIPE LOCATION	DIM Y BREAK LOCATION	DIM S STRIPE WIDTH
701	7.58712E 00	1.59000E 00	7.88017E 00
702	7.60288E 00	-1.59000E 00	7.88017E 00
703	7.61864E 00	1.59000E 00	7.88017E 00
704	7.72909E 00	-2.06968E-41	0.0
705	7.83955E 00	-1.59000E 00	7.88017E 00
706	7.85531E 00	1.59000E 00	7.88017E 00
707	7.87107E 00	-1.59000E 00	7.88017E 00
708	7.88683E 00	1.59000E 00	7.88017E 00
709	7.90259E 00	-1.59000E 00	7.88017E 00
710	7.91835E 00	1.59000E 00	7.88017E 00
711	7.93411E 00	-1.59000E 00	7.88017E 00
712	8.04457E 00	-2.06968E-41	0.0
713	8.15502E 00	-1.59000E 00	7.88017E 00
714	8.17078E 00	1.59000E 00	7.88017E 00
715	8.18654E 00	-1.59000E 00	7.88017E 00
716	8.20230E 00	1.59000E 00	7.88017E 00
717	8.21806E 00	-1.59000E 00	7.88017E 00
718	8.23382E 00	1.59000E 00	7.88017E 00
719	8.24958E 00	-1.59000E 00	7.88017E 00
720	8.36004E 00	-2.06968E-41	0.0
721	8.47050E 00	1.59000E 00	7.88017E 00
722	8.48626E 00	-1.59000E 00	7.88017E 00
723	8.50202E 00	1.59000E 00	7.88017E 00
724	8.51778E 00	-1.59000E 00	7.88017E 00
725	8.53354E 00	1.59000E 00	7.88017E 00
726	8.54930E 00	-1.59000E 00	7.88017E 00
727	8.56506E 00	1.59000E 00	7.88017E 00
728	8.67551E 00	-2.06968E-41	0.0
729	8.78597E 00	1.59000E 00	7.88017E 00
730	8.80173E 00	-1.59000E 00	7.88017E 00
731	8.81749E 00	1.59000E 00	7.88017E 00
732	8.83325E 00	-1.59000E 00	7.88017E 00
733	8.84901E 00	1.59000E 00	7.88017E 00
734	8.86477E 00	-1.59000E 00	7.88017E 00
735	8.88053E 00	1.59000E 00	7.88017E 00
736	8.99099E 00	-2.06968E-41	0.0
737	9.10144E 00	1.59000E 00	7.88017E 00
738	9.11720E 00	-1.59000E 00	7.88017E 00
739	9.13296E 00	1.59000E 00	7.88017E 00
740	9.14872E 00	-1.59000E 00	7.88017E 00
741	9.16448E 00	1.59000E 00	7.88017E 00
742	9.18024E 00	-1.59000E 00	7.88017E 00
743	9.19600E 00	1.59000E 00	7.88017E 00
744	9.30646E 00	-2.06968E-41	0.0
745	9.41691E 00	-1.59000E 00	7.88017E 00
746	9.43268E 00	1.59000E 00	7.88017E 00
747	9.44844E 00	-1.59000E 00	7.88017E 00
748	9.46420E 00	1.59000E 00	7.88017E 00
749	9.47996E 00	-1.59000E 00	7.88017E 00
750	9.49572E 00	1.59000E 00	7.88017E 00

TRANSDUCER NAME: ECOMMT TDL-100 TAPPED TRANSDUCER
DATE: JAN 23,1978
REF DES: MT2
TOTAL NUMBER OF ELECTRODE STRIPES: 1015

SIZE	FSCM NO.	DRAWING NO.	REV
A	05869	1950526	
SCALE: NONE		SHEET	20

STRIPE NO.	DIM X STRIPE LOCATION	DIM Y BREAK LOCATION	DIM S STRIPE WIDTH
751	9.51148E 00	-1.59000E 00	7.88017E 00
752	9.62193E 00	-2.06968E-41	0.0
753	9.73239E 00	-1.59000E 00	7.88017E 00
754	9.74815E 00	1.59000E 00	7.88017E 00
755	9.76391E 00	-1.59000E 00	7.88017E 00
756	9.77967E 00	1.59000E 00	7.88017E 00
757	9.79543E 00	-1.59000E 00	7.88017E 00
758	9.81119E 00	1.59000E 00	7.88017E 00
759	9.82695E 00	-1.59000E 00	7.88017E 00
760	9.93741E 00	-2.06968E-41	0.0
761	1.00479E 01	1.59000E 00	7.88017E 00
762	1.00636E 01	-1.59000E 00	7.88017E 00
763	1.00794E 01	1.59000E 00	7.88017E 00
764	1.00951E 01	-1.59000E 00	7.88017E 00
765	1.01109E 01	1.59000E 00	7.88017E 00
766	1.01267E 01	-1.59000E 00	7.88017E 00
767	1.01424E 01	1.59000E 00	7.88017E 00
768	1.02529E 01	-2.06968E-41	0.0
769	1.03633E 01	-1.59000E 00	7.88017E 00
770	1.03791E 01	1.59000E 00	7.88017E 00
771	1.03949E 01	-1.59000E 00	7.88017E 00
772	1.04106E 01	1.59000E 00	7.88017E 00
773	1.04264E 01	-1.59000E 00	7.88017E 00
774	1.04421E 01	1.59000E 00	7.88017E 00
775	1.04579E 01	-1.59000E 00	7.88017E 00
776	1.05684E 01	-2.06968E-41	0.0
777	1.06788E 01	1.59000E 00	7.88017E 00
778	1.06946E 01	-1.59000E 00	7.88017E 00
779	1.07103E 01	1.59000E 00	7.88017E 00
780	1.07261E 01	-1.59000E 00	7.88017E 00
781	1.07418E 01	1.59000E 00	7.88017E 00
782	1.07576E 01	-1.59000E 00	7.88017E 00
783	1.07734E 01	1.59000E 00	7.88017E 00
784	1.08838E 01	-2.06968E-41	0.0
785	1.09943E 01	1.59000E 00	7.88017E 00
786	1.10100E 01	-1.59000E 00	7.88017E 00
787	1.10258E 01	1.59000E 00	7.88017E 00
788	1.10416E 01	-1.59000E 00	7.88017E 00
789	1.10573E 01	1.59000E 00	7.88017E 00
790	1.10731E 01	-1.59000E 00	7.88017E 00
791	1.10888E 01	1.59000E 00	7.88017E 00
792	1.11993E 01	-2.06968E-41	0.0
793	1.13098E 01	-1.59000E 00	7.88017E 00
794	1.13255E 01	1.59000E 00	7.88017E 00
795	1.13413E 01	-1.59000E 00	7.88017E 00
796	1.13570E 01	1.59000E 00	7.88017E 00
797	1.13728E 01	-1.59000E 00	7.88017E 00
798	1.13886E 01	1.59000E 00	7.88017E 00
799	1.14043E 01	-1.59000E 00	7.88017E 00
800	1.15148E 01	-2.06968E-41	0.0

TRANSDUCER NAME: ECOMMT TDL-100 TAPPED TRANSDUCER
DATE: JAN 23,1978
REF DES: MT2
TOTAL NUMBER OF ELECTRODE STRIPES: 1015

SIZE FSCM NO. DRAWING NO. REV
A 05869 1950526
SCALE: NONE SHEET 21

STRIPE NO.	DIM X STRIPE LOCATION	DIM Y BREAK LOCATION	DIM S STRIPE WIDTH
801	1.16252E 01	1.59000E 00	7.88017E 00
802	1.16410E 01	-1.59000E 00	7.88017E 00
803	1.16567E 01	1.59000E 00	7.88017E 00
804	1.16725E 01	-1.59000E 00	7.88017E 00
805	1.16883E 01	1.59000E 00	7.88017E 00
806	1.17040E 01	-1.59000E 00	7.88017E 00
807	1.17198E 01	1.59000E 00	7.88017E 00
808	1.18302E 01	-2.06968E-41	0.0
809	1.19407E 01	-1.59000E 00	7.88017E 00
810	1.19565E 01	1.59000E 00	7.88017E 00
811	1.19722E 01	-1.59000E 00	7.88017E 00
812	1.19880E 01	1.59000E 00	7.88017E 00
813	1.20037E 01	-1.59000E 00	7.88017E 00
814	1.20195E 01	1.59000E 00	7.88017E 00
815	1.20353E 01	-1.59000E 00	7.88017E 00
816	1.21457E 01	-2.06968E-41	0.0
817	1.22562E 01	-1.59000E 00	7.88017E 00
818	1.22719E 01	1.59000E 00	7.88017E 00
819	1.22877E 01	-1.59000E 00	7.88017E 00
820	1.23035E 01	1.59000E 00	7.88017E 00
821	1.23192E 01	-1.59000E 00	7.88017E 00
822	1.23350E 01	1.59000E 00	7.88017E 00
823	1.23507E 01	-1.59000E 00	7.88017E 00
824	1.24612E 01	-2.06968E-41	0.0
825	1.25716E 01	-1.59000E 00	7.88017E 00
826	1.25874E 01	1.59000E 00	7.88017E 00
827	1.26032E 01	-1.59000E 00	7.88017E 00
828	1.26189E 01	1.59000E 00	7.88017E 00
829	1.26347E 01	-1.59000E 00	7.88017E 00
830	1.26504E 01	1.59000E 00	7.88017E 00
831	1.26662E 01	-1.59000E 00	7.88017E 00
832	1.27767E 01	-2.06968E-41	0.0
833	1.28871E 01	1.59000E 00	7.88017E 00
834	1.29029E 01	-1.59000E 00	7.88017E 00
835	1.29186E 01	1.59000E 00	7.88017E 00
836	1.29344E 01	-1.59000E 00	7.88017E 00
837	1.29502E 01	1.59000E 00	7.88017E 00
838	1.29659E 01	-1.59000E 00	7.88017E 00
839	1.29817E 01	1.59000E 00	7.88017E 00
840	1.30921E 01	-2.06968E-41	0.0
841	1.32026E 01	-1.59000E 00	7.88017E 00
842	1.32184E 01	1.59000E 00	7.88017E 00
843	1.32341E 01	-1.59000E 00	7.88017E 00
844	1.32499E 01	1.59000E 00	7.88017E 00
845	1.32656E 01	-1.59000E 00	7.88017E 00
846	1.32814E 01	1.59000E 00	7.88017E 00
847	1.32972E 01	-1.59000E 00	7.88017E 00
848	1.34076E 01	-2.06968E-41	0.0
849	1.35181E 01	-1.59000E 00	7.88017E 00
850	1.35338E 01	1.59000E 00	7.88017E 00

TRANSDUCER NAME: ECOMMT TDL-100 TAPPED TRANSDUCER
DATE: JAN 23,1978
REF DES: MT2
TOTAL NUMBER OF ELECTRODE STRIPES: 1015

SIZE	FSCM NO.	DRAWING NO.	REV
A	05869	1950526	
SCALE: NONE		SHEET	22

STRIPE NO.	DIM X STRIPE LOCATION	DIM Y BREAK LOCATION	DIM S STRIPE WIDTH
851	1.35496E 01	-1.59000E 00	7.88017E 00
852	1.35653E 01	1.59000E 00	7.88017E 00
853	1.35811E 01	-1.59000E 00	7.88017E 00
854	1.35969E 01	1.59000E 00	7.88017E 00
855	1.36126E 01	-1.59000E 00	7.88017E 00
856	1.37231E 01	-2.06968E-41	0.0
857	1.38335E 01	-1.59000E 00	7.88017E 00
858	1.38493E 01	1.59000E 00	7.88017E 00
859	1.38651E 01	-1.59000E 00	7.88017E 00
860	1.38808E 01	1.59000E 00	7.88017E 00
861	1.38966E 01	-1.59000E 00	7.88017E 00
862	1.39123E 01	1.59000E 00	7.88017E 00
863	1.39281E 01	-1.59000E 00	7.88017E 00
864	1.40386E 01	-2.06968E-41	0.0
865	1.41490E 01	1.59000E 00	7.88017E 00
866	1.41648E 01	-1.59000E 00	7.88017E 00
867	1.41805E 01	1.59000E 00	7.88017E 00
868	1.41963E 01	-1.59000E 00	7.88017E 00
869	1.42121E 01	1.59000E 00	7.88017E 00
870	1.42278E 01	-1.59000E 00	7.88017E 00
871	1.42436E 01	1.59000E 00	7.88017E 00
872	1.43540E 01	-2.06968E-41	0.0
873	1.44645E 01	1.59000E 00	7.88017E 00
874	1.44802E 01	-1.59000E 00	7.88017E 00
875	1.44960E 01	1.59000E 00	7.88017E 00
876	1.45118E 01	-1.59000E 00	7.88017E 00
877	1.45275E 01	1.59000E 00	7.88017E 00
878	1.45433E 01	-1.59000E 00	7.88017E 00
879	1.45590E 01	1.59000E 00	7.88017E 00
880	1.46695E 01	-2.06968E-41	0.0
881	1.47800E 01	-1.59000E 00	7.88017E 00
882	1.47957E 01	1.59000E 00	7.88017E 00
883	1.48115E 01	-1.59000E 00	7.88017E 00
884	1.48272E 01	1.59000E 00	7.88017E 00
885	1.48430E 01	-1.59000E 00	7.88017E 00
886	1.48588E 01	1.59000E 00	7.88017E 00
887	1.48745E 01	-1.59000E 00	7.88017E 00
888	1.49850E 01	-2.06968E-41	0.0
889	1.50954E 01	-1.59000E 00	7.88017E 00
890	1.51112E 01	1.59000E 00	7.88017E 00
891	1.51270E 01	-1.59000E 00	7.88017E 00
892	1.51427E 01	1.59000E 00	7.88017E 00
893	1.51585E 01	-1.59000E 00	7.88017E 00
894	1.51742E 01	1.59000E 00	7.88017E 00
895	1.51900E 01	-1.59000E 00	7.88017E 00
896	1.53005E 01	-2.06968E-41	0.0
897	1.54109E 01	1.59000E 00	7.88017E 00
898	1.54267E 01	-1.59000E 00	7.88017E 00
899	1.54424E 01	1.59000E 00	7.88017E 00
900	1.54582E 01	-1.59000E 00	7.88017E 00

TRANSDUCER NAME: ECOMMT TDL-100 TAPPED TRANSDUCER
DATE: JAN 23,1978
REF DES: MT2
TOTAL NUMBER OF ELECTRODE STRIPES: 1015

SIZE	FSCM NO.	DRAWING NO.	REV
A	05869	1950526	.
SCALE: NONE		SHEET	23

STRIPE NO.	DIM X STRIPE LOCATION	DIM Y BREAK LOCATION	DIM S STRIPE WIDTH
901	1.54739E 01	1.59000E 00	7.88017E 00
902	1.54897E 01	-1.59000E 00	7.88017E 00
903	1.55055E 01	1.59000E 00	7.88017E 00
904	1.56159E 01	-2.06968E-41	0.0
905	1.57264E 01	1.59000E 00	7.88017E 00
906	1.57421E 01	-1.59000E 00	7.88017E 00
907	1.57579E 01	1.59000E 00	7.88017E 00
908	1.57737E 01	-1.59000E 00	7.88017E 00
909	1.57894E 01	1.59000E 00	7.88017E 00
910	1.58052E 01	-1.59000E 00	7.88017E 00
911	1.58209E 01	1.59000E 00	7.88017E 00
912	1.59314E 01	-2.06968E-41	0.0
913	1.60418E 01	-1.59000E 00	7.88017E 00
914	1.60576E 01	1.59000E 00	7.88017E 00
915	1.60734E 01	-1.59000E 00	7.88017E 00
916	1.60891E 01	1.59000E 00	7.88017E 00
917	1.61049E 01	-1.59000E 00	7.88017E 00
918	1.61207E 01	1.59000E 00	7.88017E 00
919	1.61364E 01	-1.59000E 00	7.88017E 00
920	1.62469E 01	-2.06968E-41	0.0
921	1.63573E 01	1.59000E 00	7.88017E 00
922	1.63731E 01	-1.59000E 00	7.88017E 00
923	1.63888E 01	1.59000E 00	7.88017E 00
924	1.64046E 01	-1.59000E 00	7.88017E 00
925	1.64204E 01	1.59000E 00	7.88017E 00
926	1.64361E 01	-1.59000E 00	7.88017E 00
927	1.64519E 01	1.59000E 00	7.88017E 00
928	1.65623E 01	-2.06968E-41	0.0
929	1.66728E 01	-1.59000E 00	7.88017E 00
930	1.66886E 01	1.59000E 00	7.88017E 00
931	1.67043E 01	-1.59000E 00	7.88017E 00
932	1.67201E 01	1.59000E 00	7.88017E 00
933	1.67358E 01	-1.59000E 00	7.88017E 00
934	1.67516E 01	1.59000E 00	7.88017E 00
935	1.67673E 01	-1.59000E 00	7.88017E 00
936	1.68778E 01	-2.06968E-41	0.0
937	1.69883E 01	1.59000E 00	7.88017E 00
938	1.70040E 01	-1.59000E 00	7.88017E 00
939	1.70198E 01	1.59000E 00	7.88017E 00
940	1.70356E 01	-1.59000E 00	7.88017E 00
941	1.70513E 01	1.59000E 00	7.88017E 00
942	1.70671E 01	-1.59000E 00	7.88017E 00
943	1.70828E 01	1.59000E 00	7.88017E 00
944	1.71933E 01	-2.06968E-41	0.0
945	1.73037E 01	-1.59000E 00	7.88017E 00
946	1.73195E 01	1.59000E 00	7.88017E 00
947	1.73353E 01	-1.59000E 00	7.88017E 00
948	1.73510E 01	1.59000E 00	7.88017E 00
949	1.73668E 01	-1.59000E 00	7.88017E 00
950	1.73825E 01	1.59000E 00	7.88017E 00

TRANSDUCER NAME: ECOMMT TDL-100 TAPPED TRANSDUCER
DATE: JAN 23,1978
REF DES: MT2
TOTAL NUMBER OF ELECTRODE STRIPES: 1015

SIZE	FSCM NO.	DRAWING NO.	REV
A	05869	1950526	
SCALE: NONE		SHEET	24

STRIPE NO.	DIM X STRIPE LOCATION	DIM Y BREAK LOCATION	DIM S STRIPE WIDTH
951	1.73983E 01	-1.59000E 00	7.88017E 00
952	1.75088E 01	-2.06968E-41	0.0
953	1.76192E 01	1.59000E 00	7.88017E 00
954	1.76350E 01	-1.59000E 00	7.88017E 00
955	1.76507E 01	1.59000E 00	7.88017E 00
956	1.76665E 01	-1.59000E 00	7.88017E 00
957	1.76823E 01	1.59000E 00	7.88017E 00
958	1.76980E 01	-1.59000E 00	7.88017E 00
959	1.77138E 01	1.59000E 00	7.88017E 00
960	1.78242E 01	-2.06968E-41	0.0
961	1.79347E 01	-1.59000E 00	7.88017E 00
962	1.79504E 01	1.59000E 00	7.88017E 00
963	1.79662E 01	-1.59000E 00	7.88017E 00
964	1.79820E 01	1.59000E 00	7.88017E 00
965	1.79977E 01	-1.59000E 00	7.88017E 00
966	1.80135E 01	1.59000E 00	7.88017E 00
967	1.80293E 01	-1.59000E 00	7.88017E 00
968	1.81397E 01	-2.06968E-41	0.0
969	1.82502E 01	-1.59000E 00	7.88017E 00
970	1.82659E 01	1.59000E 00	7.88017E 00
971	1.82817E 01	-1.59000E 00	7.88017E 00
972	1.82974E 01	1.59000E 00	7.88017E 00
973	1.83132E 01	-1.59000E 00	7.88017E 00
974	1.83290E 01	1.59000E 00	7.88017E 00
975	1.83447E 01	-1.59000E 00	7.88017E 00
976	1.84552E 01	-2.06968E-41	0.0
977	1.85656E 01	-1.59000E 00	7.88017E 00
978	1.85814E 01	1.59000E 00	7.88017E 00
979	1.85972E 01	-1.59000E 00	7.88017E 00
980	1.86129E 01	1.59000E 00	7.88017E 00
981	1.86287E 01	-1.59000E 00	7.88017E 00
982	1.86444E 01	1.59000E 00	7.88017E 00
983	1.86602E 01	-1.59000E 00	7.88017E 00
984	1.87706E 01	-2.06968E-41	0.0
985	1.88811E 01	-1.59000E 00	7.88017E 00
986	1.88969E 01	1.59000E 00	7.88017E 00
987	1.89126E 01	-1.59000E 00	7.88017E 00
988	1.89284E 01	1.59000E 00	7.88017E 00
989	1.89441E 01	-1.59000E 00	7.88017E 00
990	1.89599E 01	1.59000E 00	7.88017E 00
991	1.89757E 01	-1.59000E 00	7.88017E 00
992	1.90861E 01	-2.06968E-41	0.0
993	1.91966E 01	-1.59000E 00	7.88017E 00
994	1.92123E 01	1.59000E 00	7.88017E 00
995	1.92281E 01	-1.59000E 00	7.88017E 00
996	1.92439E 01	1.59000E 00	7.88017E 00
997	1.92596E 01	-1.59000E 00	7.88017E 00
998	1.92754E 01	1.59000E 00	7.88017E 00
999	1.92911E 01	-1.59000E 00	7.88017E 00
1000	1.94016E 01	-2.06968E-41	0.0

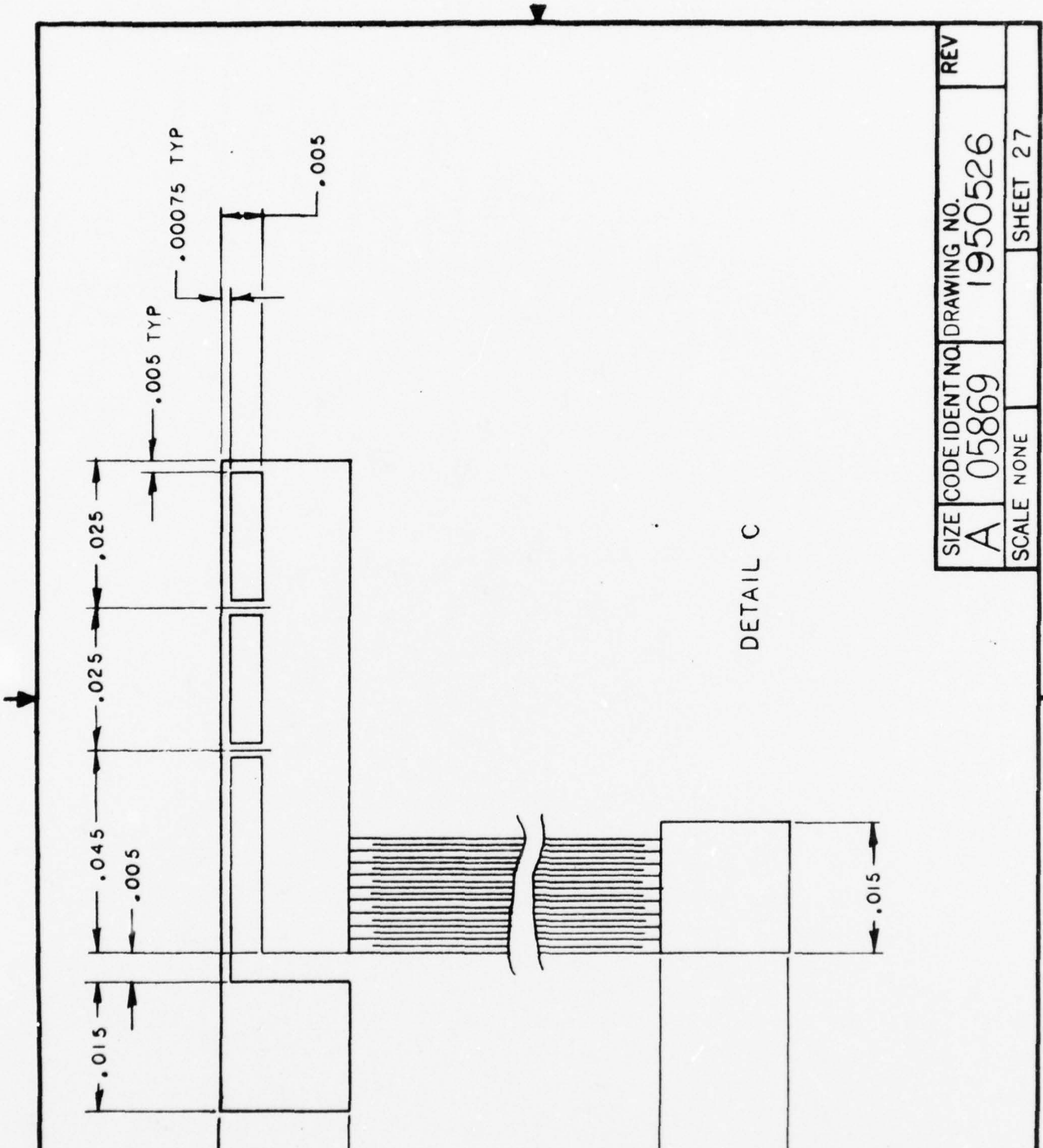
TRANSDUCER NAME: ECOMMT TDL-100 TAPPED TRANSDUCER
DATE: JAN 23,1978
REF DES: MT2
TOTAL NUMBER OF ELECTRODE STRIPES: 1015

SIZE A | FSCM NO. 05869 | DRAWING NO. 1950526 | REV
SCALE: NONE | SHEET 25

STRIPE NO.	DIM X STRIPE LOCATION	DIM Y BREAK LOCATION	DIM S STRIPE WIDTH
1001	1.95121E 01	-1.59000E 00	7.88017E 00
1002	1.95278E 01	1.59000E 00	7.88017E 00
1003	1.95436E 01	-1.59000E 00	7.88017E 00
1004	1.95593E 01	1.59000E 00	7.88017E 00
1005	1.95751E 01	-1.59000E 00	7.88017E 00
1006	1.95909E 01	1.59000E 00	7.88017E 00
1007	1.96066E 01	-1.59000E 00	7.88017E 00
1008	1.97171E 01	-2.06968E-41	0.0
1009	1.98275E 01	-1.59000E 00	7.88017E 00
1010	1.98433E 01	1.59000E 00	7.88017E 00
1011	1.98590E 01	-1.59000E 00	7.88017E 00
1012	1.98748E 01	1.59000E 00	7.88017E 00
1013	1.98906E 01	-1.59000E 00	7.88017E 00
1014	1.99063E 01	1.59000E 00	7.88017E 00
1015	1.99221E 01	-1.59000E 00	7.88017E 00

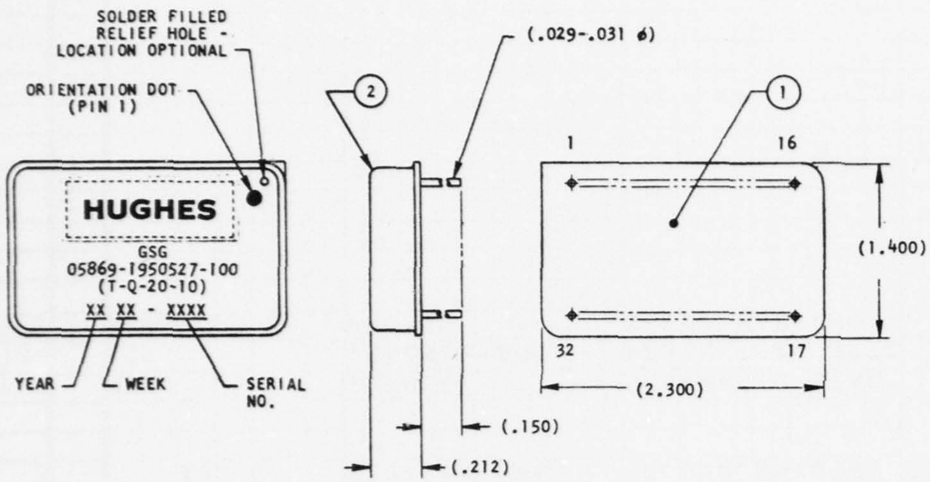
TRANSDUCER NAME: ECOMMT TDL-100 TAPPED TRANSDUCER
DATE: JAN 23,1978
REF DES: MT2
TOTAL NUMBER OF ELECTRODE STRIPES: 1015

SIZE	FSCM NO.	DRAWING NO.	REV
A	05869	1950526	
SCALE: NONE		SHEET	26


DETAIL C
.005 TYP
.00075 TYP
.005
.025
.025
.045
.005
.015
.015
.015
.135
.015
SIZE
A
CODE IDENT NO.
05869
DRAWING NO.
1950526
REV
SCALE NONE
SHEET 27
11-061-1 CS-GS 10/73

92508-5

REVISIONS					
AUTHORITY	ZONE	LTR	DESCRIPTION	DATE	APPROVED
DDT 74356		-	PRODUCTION RELEASE	77-11-10	



NOTES - UNLESS OTHERWISE SPECIFIED

1. FOR SCHEMATIC DIAGRAM SEE 1950528.
2. THIS ITEM SHALL MEET THE REQUIREMENTS OF 1950512-600.
3. IDENTIFICATION MARKING PER P80-3.
4. SEAL ASSEMBLY USING ITEM 3 OR BY PROJECTION WELDING (MFG OPTION).

SEE SEPARATE PARTS LIST

- / NEXT ASSY	SAW MMT / USED ON	EXCEPT AS NOTED DIM. ARE IN INCHES AND PER ANS Y14.5 .XXX ±.010 .XX ±.03 ANGLES ±0°30'	CONTRACT: DAAB07-75-C-0044
APPLICATION		MATERIAL	DR L. Y. Arakaki 77-10-28
			CHK R. Burns 77-10-29
			APPD 77-11-09

HUGHES — HUGHES AIRCRAFT COMPANY FULLERTON, CALIFORNIA

DELAY LINE, SURFACE ACOUSTIC WAVE – CENTER FREQ 200 MHz, BANDWIDTH 10 MHz (TAPPED DELAY LINE FORWARD CODE)

SIZE	CODE IDENT NO	DRAWING NO.	REV
B	05869	1950527-100	
SCALE NONE		SHEET	

11-063B-1 GS 7/73 12-66-42 FORM 3

PARTS LIST TRANSMITTAL

HUGHES AIRCRAFT COMPANY
FULLERTON, CALIFORNIA

ISSUE: | ACTION: A

10 CONTRACT: DAAB07-75-C-0044

PL 1950527-100

05869

77 09 23

12 LIST TITLE: DELAY LINE, SAW

13 MAINT:

14 PROJECT: SAW MMT

15 REFERENCE NO.:

16 REV AUTH:

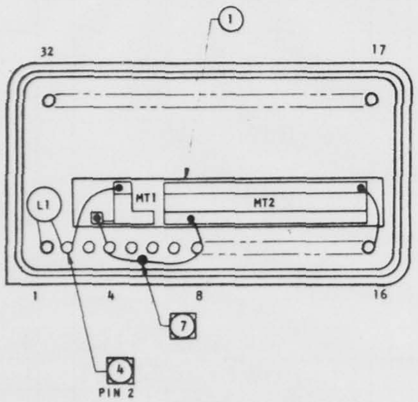
SHEET 1 OF 1

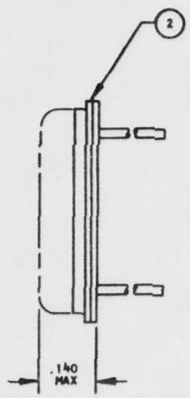
	ITEM NO.	UNIT NO.	QUANTITY REQUIRED (20)	UNIT OF MEAS (21)	CODE IDENT (22)	PART OR IDENT NUMBER (23)	DESCRIPTION (24)	SPECIFICATION OR REFERENCE (25)	REF DESIGNATION FROM (26)	THRU (27)	AUTH (28)	WT LB
A	1		1			1950528	SUBASSY					
A	2		1		29172	20118-175	COVER	TEKFORM				
A	3		AR			4277250-996	SOLDER, SN96IW5	QQ-S-571				
A	4900		REF			1950528	SCHEMATIC DIAG					
A	4901		REF			1950512-600	DESGN PERF SPEC					
A	4902		REF			P80-3	IDENT MARKING					

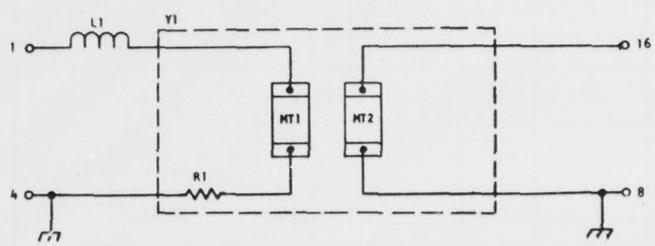
PREPARED BY: Ho. Burns | DATE: 77-09-23 | CHECKED BY: | DATE: 77- | APPROVED BY: | DATE: 77-11-09 | APPROVED BY: | DATE: 77-

92508-7

AUTHORITY	LTR	DESCRIPTION	DATE	APPROVED
DDT 74356	-	PRODUCTION RELEASE	77-11-10	







SCHEMATIC DIAGRAM

NOTES - UNLESS OTHERWISE SPECIFIED:

1. ATTACH ITEM 1 TO ITEM 2 USING ITEM 7.
2. SOLDER LEADS OF L1 TO HEADER PINS AS SHOWN USING ITEM 8.
3. ALL OTHER CONNECTIONS ARE WIRE BONDS PER MIL-STD-883, METHOD 2017 USING ITEM 6.
4. CLIP INDICATED PIN FLUSH WITH FAR SIDE OF HEADER.
5. (NOT USED)
6. TUNE L1 TO MEET THE PERFORMANCE REQUIREMENTS OF 19500512-600 BY ADJUSTING SPACING BETWEEN TURNS. THEN BOND TO ITEM 2 USING ITEM 7.
7. SOLDER CONNECTION TO HEADER AS SHOWN USING ITEM 8.

SEE SEPARATE PARTS LIST

1950527-100	SAW MMT	EXCEPT AS NOTED DIM ARE IN INCHES AND PER ANSI Y14.5 .XXX .XX ANGLES ±.010 ±.03 ±0.5° MATERIAL	CONTRACT: DAAB07-75-C-0044	HUGHES — HUGHES AIRCRAFT COMPANY FULLERTON, CALIFORNIA
NEXT ASSY	USED ON		DR 77-11-08	DELAY LINE SUBASSEMBLY, SURFACE ACOUSTIC WAVE - CENTER FREQ 200 MHz, BANDWIDTH 10 MHz
APPLICATION			CHK 77-11-09	SIZE C — FSCM NO 05869 — DWG NO 1950528 — REV
		12-67-31	APPD 77-11-09 FORM 3	SCALE NONE — SHEET

DWG NO 1950528 SH REV

PARTS LIST TRANSMITTAL

HUGHES AIRCRAFT COMPANY
FULLERTON, CALIFORNIA

ISSUE: | ACTION: A

10 CONTRACT: DAAB07-75-C-0044

PL 1950528 | CODE IDENT 05869 | 11 YR MO: 77 09 -

12 LIST TITLE: DELAY LINE SUBASSY, SAW

13 MAINT: | 14 PROJECT: MMT | 15 REFERENCE NO.: | 16 REV AUTH:

SHEET 1 OF 1

	ITEM NO.	LINE NO.	QUANTITY REQUIRED (20)	UNIT OF MEAS (21)	CODE IDENT (22)	PART OR IDENT NUMBER (23)	DESCRIPTION (24)	SPECIFICATION OR REFERENCE (25)	REF DESIGNATION FROM (26)	THRU (27)	AUTH (28)	WT LB (29)	PL NOTE (30)
A	1		1			1950529	CRYSTAL		Y1				
A	2		1		29172	20117	HEADER	TEKFORM					
A	3		1		55167	850-24	COIL	CORONA MAG	L1				
N	4												
N	5												
A	6		AR			760660-11	WIRE, GOLD .001						
A	7		AR		71984	3140 RTV	ADHESIVE	DOW CORNING					
A	8		AR			4277250-999	SOLDER, SN63	QQ-S-571					
A	4900		REF			MIL-STD-883	WIRE BOND SPEC						

PREPARED BY: R. Burns | DATE: 77-09-26 | CHECKED BY: | DATE: 77- - | APPROVED BY: [signature] | DATE: 77-11-09 | APPROVED BY: | DATE: 77- -

HS 318 GS 12/70

HUGHES

FSCM NO. 05869

☒ ENGINEERING ORDER
☐ DOCUMENT CHANGE NOTICE

☐ CLASS I ☒ CLASS II ☐ COMPATIBILITY CLASS II ☐ RECORD CORRECTION

CHANGE IDENT NO. 75393 — SHEET 1 OF 1

TITLE	PROJECT	ECP/UPN, ETC.	DRAWING NO.	REV.	NO.
DELAY LINE SUBASSEMBLY SAW CENTER FREQ 100 MHZ, BANDWITH 10MHZ	RAYTHEON / SAW		1950528	—	1

EFFECTIVITY: ☒ MANDATORY ☐ MANUFACTURING CONVENIENCE ☐ MANUFACTURING OPTION

	ORG CODE	DATE		ORG CODE	DATE
PREPARED BY: RD YOVAN	12-67-10	77-12-12	APPROVED: F. A. Lengiro	12-67-10	77-12-12
CHECKED BY: W. Voigt ✓CE	12-66-42	77-12-12			
PL MAINTENANCE					

CONTROL ITEM DRAWING NO.	FROM	THRU	CONFIGURATION ITEM DRAWING NO.	FROM	THRU
1950527-100	1	UP			

DISPOSITION OF ITEMS: ☐ ITEMS CONFORM ☐ USE ☐ REWORK AS FOLLOWS: SEE REWORK INSTRUCTIONS

REASON AND DESCRIPTION – SEE BELOW FOR P/L CHANGES

REASON : CLIPPED HEADER PINS NOT REQUIRED ON SAW DEVICE

IN G/N:

IS

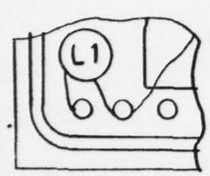
4. NOT USED

WAS

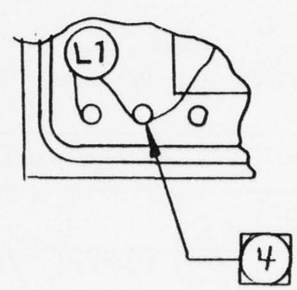
4. CLIP INDICATED PIN FLUSH WITH FARSIDE OF HEADER

ON F/D:

IS



WAS



PIN 2

STANDARD GSG GSG RELEASE

ITEM NO.	LINE NO.	ADD	DELETE	QTY REQ.	UNIT OF MEAS	MFG CODE IDENT NO.	PART OR IDENT NUMBER	DESCRIPTION	SPECIFICATION OR REFERENCE	FROM REF. DESIGNATION	THRU	WEIGHT IN LBS.	P/L NOTE	ZONE

4775 GS 5/76

HUGHES

FSCM NO. 05869

☒ **ENGINEERING ORDER**

☐ **DOCUMENT CHANGE NOTICE**

☐ CLASS I ☒ CLASS II ☐ COMPATIBILITY CLASS II ☐ RECORD CORRECTION

CHANGE IDENT NO. 77388 — SHEET 1 OF 1

TITLE	PROJECT	ECP/UPN, ETC.	DRAWING NO.	REV.	NO.
DELAY LINE SUBASSEMBLY SAW CENTER FREQUENCY 200 MHz BANDWIDTH 10 MHz	SAW MMT		1950528	-	2

TYPE OF CHANGE: ☒ MANDATORY ☐ MANUFACTURING CONVENIENCE ☐ MANUFACTURING OPTION

CONTROL ITEM DRAWING NO.	CONTROL ITEM EFFECTIVITY	CONFIGURATION ITEM DRAWING NO.	CONFIGURATION ITEM EFFECTIVITY
1950527-100	1 - UP		

	ORG CODE	DATE	APPROVED	ORG CODE	DATE
PREPARED BY L. DYAL	12-67-11	73-2-8	[signature]	12-67-11	78-2-8
CHECKED BY W. Voigt	12-66-42	78-02-08			
PL MAINTENANCE					

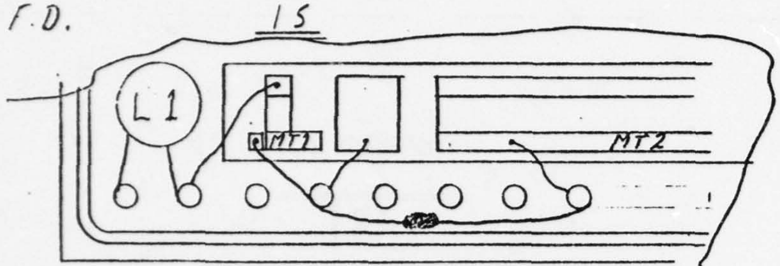
DISPOSITION OF ITEMS: ☐ ITEMS CONFORM ☐ USE ☐ REWORK AS FOLLOWS: SEE REWORK INSTRUCTIONS

REASON AND DESCRIPTION – SEE BELOW FOR P/L CHANGES

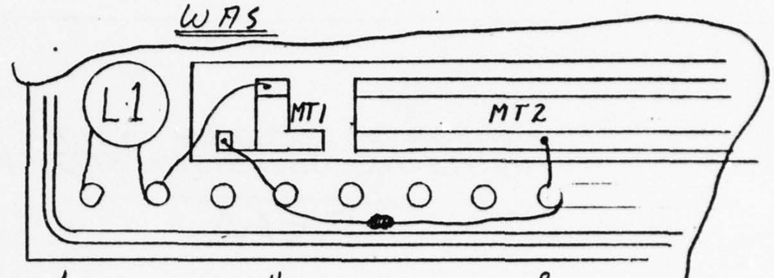
REASON: GROUND PAD AND INTERCONNECT NOT SHOWN ON FACE OF DRAWING

ON F.D.

IS



WAS



STANDARD GSG RELEASE GSG

ITEM NO.	LINE NO.	ADD	DELETE	QTY REQ.	UNIT OF MEAS	MFG CODE IDENT NO.	PART OR IDENT NUMBER	DESCRIPTION	SPECIFICATION OR REFERENCE	FROM REF. DESIGNATION	THRU REF. DESIGNATION	WEIGHT IN LBS.	P/L NOTE	ZONE

4775 OG 1/77

REVISIONS

AUTHORITY	LTR	DESCRIPTION	DATE	APPROVED
DDT86948	-	PRODUCTION RELEASE	78-08-29	J.A.J.

NOTES:

1. MATERIAL: QUARTZ PER 760781-100
2. FABRICATE PER 780294
3. DEPOSITION THICKNESS:
   0.125 ±0.01 µm
   (1250) ±100 Å)

(4) INDICATES DIRECTION OF SPECIFIED CRYSTALLINE AXIS & PROPAGATION DIRECTION.

(5) HORIZONTAL CENTERLINES OF MT1 & MT2 SHALL BE CO-LINEAR WITHIN AND PARALLEL TO -AXIS WITHIN 0.25°.

6. IN DIMENSIONAL LISTINGS, THE NO. FOLLOWING THE LETTER E INDICATES THE POWER OF 10 BY WHICH THE NO. MUST BE MULTIPLIED TO OBTAIN THE CORRECT VALUE. FOR EXAMPLE:

   $1.45870E-02 = 1.45870 \times 10^{-2} = 0.014587$

   $1.34567E\ 00 = 1.34567 \times 10^{0} = 1.34567$

(7) DEPOSITION FILM APPLIED IN INDICATED AREA.

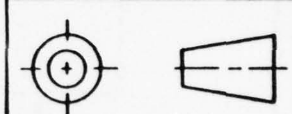
8. INDICATED SURFACE TO BE CORRUGATED PER P82.
9. BACK SURFACE TO BE ROUGHENED WITH #180 GRIT.

(10) DIMENSION TO BE DETERMINED AT TIME OF FABRICATION.

FRAGILE ITEM (EASILY DAMAGED BY HANDLING) - TO BE INSTALLED IN NEXT ASSEMBLY AT POINT OF MANUFACTURE.

METRIC

THIRD ANGLE (AMERICAN) PROJECTION



1950528	SAW/MMT	
NEXT ASSY	USED ON	
APPLICATION		

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN MILLIMETERS & PER ANSI Y14.5

.XXX	±0.002
.XX	±0.02
.X	±0.5
ANGLES	±2°

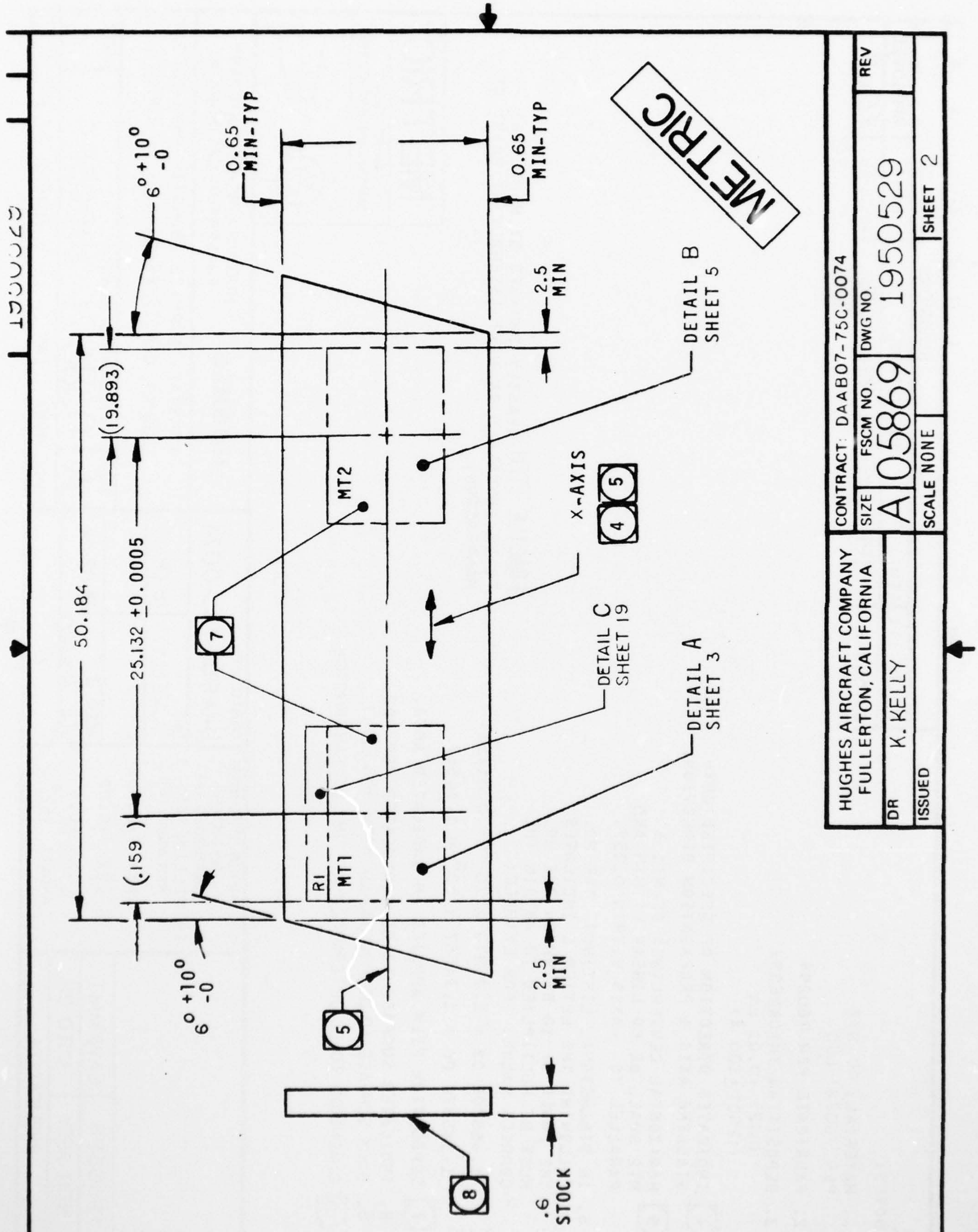
CONTRACT: DAAB07-75C-0074	
DR K.KELLY	78-08-29
CHK	
APPD [signature]	78.09.06

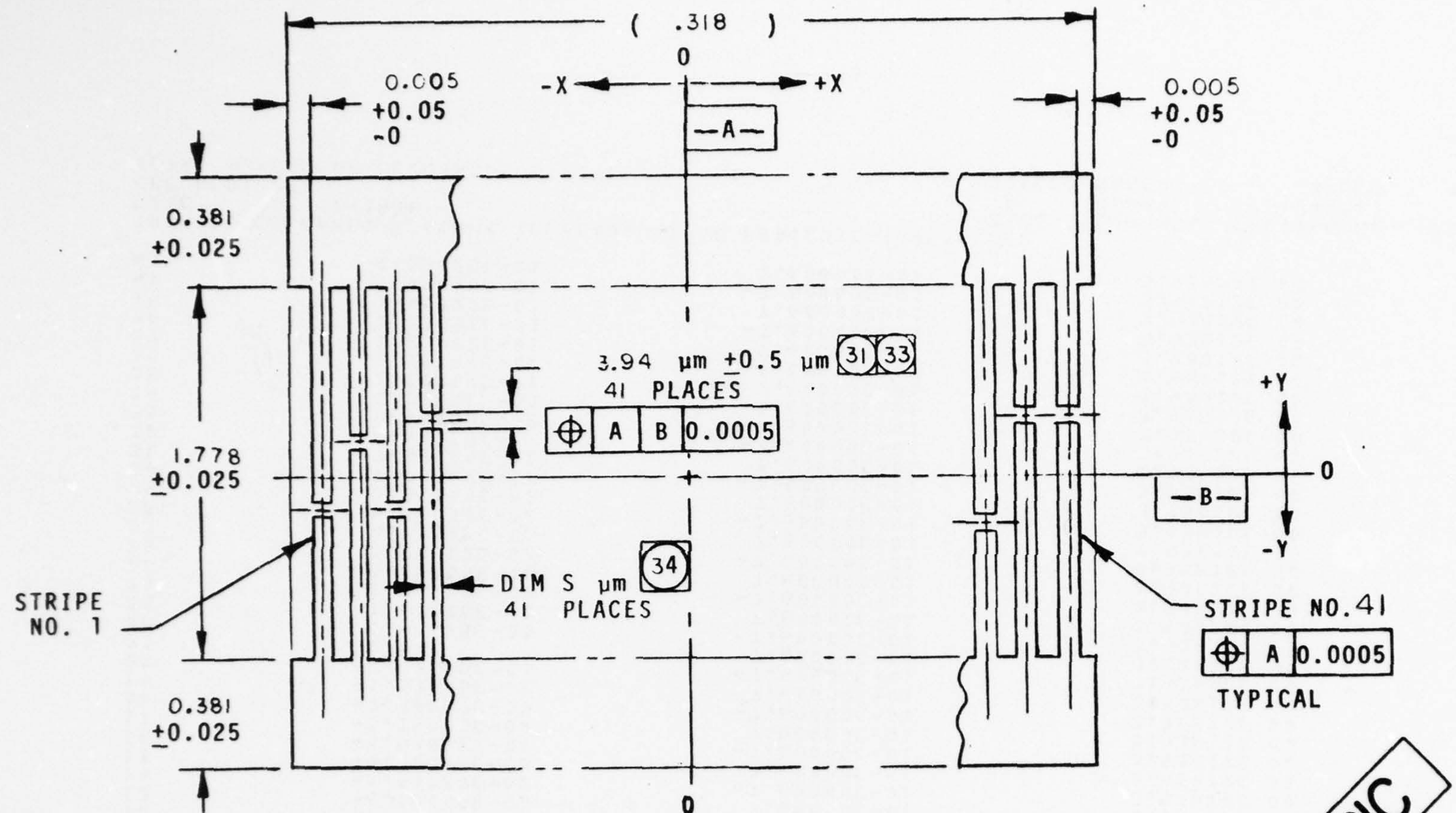
HUGHES

HUGHES AIRCRAFT COMPANY
FULLERTON, CALIFORNIA

CRYSTAL, SURFACE ACOUSTIC WAVE-TDL 200 - 200 MH_z CENTER FREQ., 10 MH_z BANDWIDTH

SIZE	FSCM NO.	DWG NO.	REV
A	05869	1950529	
SCALE NONE	WT	SHEET 1 OF 19	


METRIC
HUGHES AIRCRAFT COMPANY
FULLERTON, CALIFORNIA
CONTRACT: DAAB07-75C-0074
SIZE A
FSCM NO. 05869
DWG NO. 1950529
REV
DR K. KELLY
ISSUED
SCALE NONE
SHEET 2
50.184
25.132 ±0.0005
(19.893)
(.159)
6° +10° -0
0.65 MIN-TYP
2.5 MIN
.6 STOCK
MT1
MT2
R1
X-AXIS
DETAIL A SHEET 3
DETAIL B SHEET 5
DETAIL C SHEET 19
4
5
7
8



DETAIL A

MTI

METRIC

NOTES:

(31) FOR DIM S, X, & Y, SEE SHEET 4.

32. DIM X ARE BASIC DIM TO CENTERLINES OF STRIPES.

(33) DIM Y ARE BASIC DIM TO CENTERLINES OF STRIPE BREAKS.

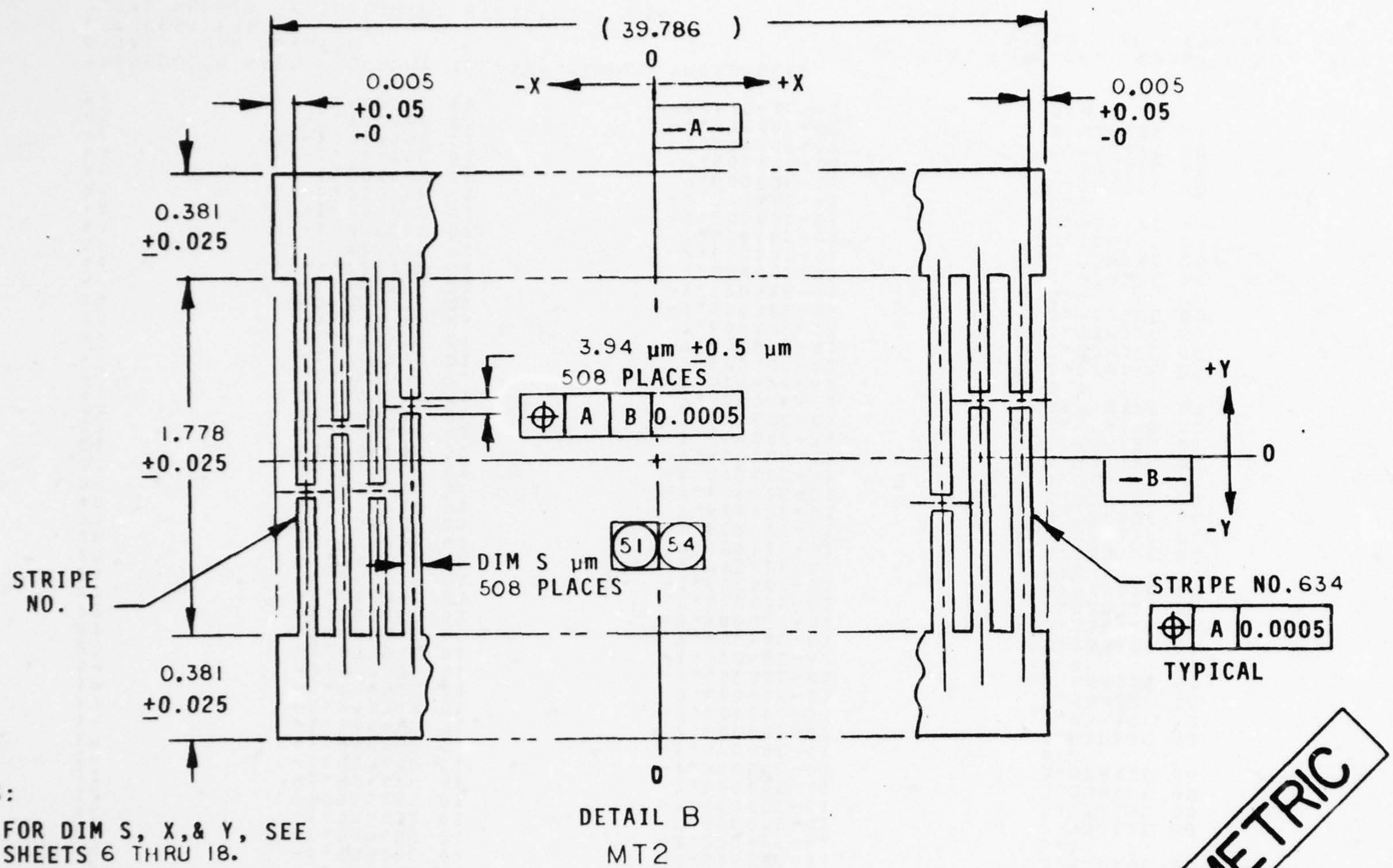
(34) TOLERANCE: ±0.1 μm PER μm.

HUGHES AIRCRAFT COMPANY FULLERTON, CALIFORNIA	CONTRACT: DAAB07-75C-0074			
	SIZE A	FSCM NO. 05869	DWG NO. 1950529	REV
DR K. KELLY				
ISSUED	SCALE NONE		SHEET 3	

STRIPE NO.	DIM X STRIPE LOCATION	DIM Y BREAK LOCATION	DIM S STRIPE WIDTH
1	-1.57525E-01	7.60000E-01	3.93812E 00
2	-1.49649E-01	-7.60000E-01	3.93812E 00
3	-1.41772E-01	7.60000E-01	3.93812E 00
4	-1.33896E-01	-7.60000E-01	3.93812E 00
5	-1.26020E-01	7.60000E-01	3.93812E 00
6	-1.18144E-01	-7.60000E-01	3.93812E 00
7	-1.10267E-01	7.60000E-01	3.93812E 00
8	-1.02391E-01	-7.60000E-01	3.93812E 00
9	-9.45150E-02	7.60000E-01	3.93812E 00
10	-8.66387E-02	-7.60000E-01	3.93812E 00
11	-7.87625E-02	7.60000E-01	3.93812E 00
12	-7.08862E-02	-7.60000E-01	3.93812E 00
13	-6.30100E-02	7.60000E-01	3.93812E 00
14	-5.51337E-02	-7.60000E-01	3.93812E 00
15	-4.72575E-02	7.60000E-01	3.93812E 00
16	-3.93812E-02	-7.60000E-01	3.93812E 00
17	-3.15050E-02	7.60000E-01	3.93812E 00
18	-2.36287E-02	-7.60000E-01	3.93812E 00
19	-1.57525E-02	7.60000E-01	3.93812E 00
20	-7.87625E-03	-7.60000E-01	3.93812E 00
21	0.0	7.60000E-01	3.93812E 00
22	7.87625E-03	-7.60000E-01	3.93812E 00
23	1.57525E-02	7.60000E-01	3.93812E 00
24	2.36287E-02	-7.60000E-01	3.93812E 00
25	3.15050E-02	7.60000E-01	3.93812E 00
26	3.93812E-02	-7.60000E-01	3.93812E 00
27	4.72575E-02	7.60000E-01	3.93812E 00
28	5.51337E-02	-7.60000E-01	3.93812E 00
29	6.30100E-02	7.60000E-01	3.93812E 00
30	7.08862E-02	-7.60000E-01	3.93812E 00
31	7.87625E-02	7.60000E-01	3.93812E 00
32	8.66387E-02	-7.60000E-01	3.93812E 00
33	9.45150E-02	7.60000E-01	3.93812E 00
34	1.02391E-01	-7.60000E-01	3.93812E 00
35	1.10267E-01	7.60000E-01	3.93812E 00
36	1.18144E-01	-7.60000E-01	3.93812E 00
37	1.26020E-01	7.60000E-01	3.93812E 00
38	1.33896E-01	-7.60000E-01	3.93812E 00
39	1.41772E-01	7.60000E-01	3.93812E 00
40	1.49649E-01	-7.60000E-01	3.93812E 00
41	1.57525E-01	7.60000E-01	3.93812E 00

TRANSDUCER NAME: ECOMMT TDL-200, 41 DE PERIODIC TRANSDUCER
DATE: JAN 23,1978
REF DES: MT1
TOTAL NUMBER OF ELECTRODE STRIPES: 41

SIZE	FSCM NO.	DRAWING NO.	REV
A	05869	1950529	
SCALE: NONE		SHEET	4



DETAIL B
MT2

NOTES:

51 FOR DIM S, X, & Y, SEE SHEETS 6 THRU 18.

52 DIM X ARE BASIC DIM TO CENTERLINES OF STRIPES.

53 DIM Y ARE BASIC DIM TO CENTERLINES OF STRIPE BREAKS.

54 TOLERANCE: ±0.1 μm PER μm.

55 ACTUAL NO. OF STRIPES IS EQUAL TO 508.

HUGHES AIRCRAFT COMPANY FULLERTON, CALIFORNIA	CONTRACT: DAAB07-75C-0074		
DR	SIZE A · FSCM NO. 05869	DWG NO. 1950529	REV
ISSUED	SCALE NONE		SHEET 5

STRIPE NO.	DIM X STRIPE LOCATION	DIM Y BREAK LOCATION	DIM S STRIPE WIDTH
1	-1.98916E 01	7.60000E-01	3.93812E 00
2	-1.98837E 01	-7.60000E-01	3.93812E 00
3	-1.98759E 01	7.60000E-01	3.93812E 00
4	-1.98680E 01	-7.60000E-01	3.93812E 00
5	-1.97220E 01	-1.37042E-41	0.0
6	-1.95760E 01	7.60000E-01	3.93812E 00
7	-1.95682E 01	-7.60000E-01	3.93812E 00
8	-1.95603E 01	7.60000E-01	3.93812E 00
9	-1.95524E 01	-7.60000E-01	3.93812E 00
10	-1.94065E 01	-1.37042E-41	0.0
11	-1.92605E 01	7.60000E-01	3.93812E 00
12	-1.92526E 01	-7.60000E-01	3.93812E 00
13	-1.92448E 01	7.60000E-01	3.93812E 00
14	-1.92369E 01	-7.60000E-01	3.93812E 00
15	-1.90909E 01	-1.37042E-41	0.0
16	-1.89449E 01	7.60000E-01	3.93812E 00
17	-1.89371E 01	-7.60000E-01	3.93812E 00
18	-1.89292E 01	7.60000E-01	3.93812E 00
19	-1.89213E 01	-7.60000E-01	3.93812E 00
20	-1.87754E 01	-1.37042E-41	0.0
21	-1.86294E 01	7.60000E-01	3.93812E 00
22	-1.86215E 01	-7.60000E-01	3.93812E 00
23	-1.86136E 01	7.60000E-01	3.93812E 00
24	-1.86058E 01	-7.60000E-01	3.93812E 00
25	-1.84598E 01	-1.37042E-41	0.0
26	-1.83138E 01	7.60000E-01	3.93812E 00
27	-1.83060E 01	-7.60000E-01	3.93812E 00
28	-1.82981E 01	7.60000E-01	3.93812E 00
29	-1.82902E 01	-7.60000E-01	3.93812E 00
30	-1.81443E 01	-1.37042E-41	0.0
31	-1.79983E 01	-7.60000E-01	3.93812E 00
32	-1.79904E 01	7.60000E-01	3.93812E 00
33	-1.79825E 01	-7.60000E-01	3.93812E 00
34	-1.79747E 01	7.60000E-01	3.93812E 00
35	-1.78287E 01	-1.37042E-41	0.0
36	-1.76827E 01	7.60000E-01	3.93812E 00
37	-1.76749E 01	-7.60000E-01	3.93812E 00
38	-1.76670E 01	7.60000E-01	3.93812E 00
39	-1.76591E 01	-7.60000E-01	3.93812E 00
40	-1.75132E 01	-1.37042E-41	0.0
41	-1.73672E 01	7.60000E-01	3.93812E 00
42	-1.73593E 01	-7.60000E-01	3.93812E 00
43	-1.73514E 01	7.60000E-01	3.93812E 00
44	-1.73436E 01	-7.60000E-01	3.93812E 00
45	-1.71976E 01	-1.37042E-41	0.0
46	-1.70516E 01	7.60000E-01	3.93812E 00
47	-1.70438E 01	-7.60000E-01	3.93812E 00
48	-1.70359E 01	7.60000E-01	3.93812E 00
49	-1.70280E 01	-7.60000E-01	3.93812E 00
50	-1.68820E 01	-1.37042E-41	0.0

TRANSDUCER NAME: ECOMMT TDL-200,TAPPED TRANSDUCER
DATE: JAN 23,1978
REF DES: MT2
TOTAL NUMBER OF ELECTRODE STRIPES: 634

SIZE	FSCM NO.	DRAWING NO.	REV
A	05869	1950529	
SCALE: NONE		SHEET	6

STRIPE NO.	DIM X STRIPE LOCATION	DIM Y BREAK LOCATION	DIM S STRIPE WIDTH
51	-1.67361E 01	7.60000E-01	3.93812E 00
52	-1.67282E 01	-7.60000E-01	3.93812E 00
53	-1.67203E 01	7.60000E-01	3.93812E 00
54	-1.67124E 01	-7.60000E-01	3.93812E 00
55	-1.65665E 01	-1.37042E-41	0.0
56	-1.64205E 01	7.60000E-01	3.93812E 00
57	-1.64127E 01	-7.60000E-01	3.93812E 00
58	-1.64048E 01	7.60000E-01	3.93812E 00
59	-1.63969E 01	-7.60000E-01	3.93812E 00
60	-1.62509E 01	-1.37042E-41	0.0
61	-1.61050E 01	-7.60000E-01	3.93812E 00
62	-1.60971E 01	7.60000E-01	3.93812E 00
63	-1.60892E 01	-7.60000E-01	3.93812E 00
64	-1.60813E 01	7.60000E-01	3.93812E 00
65	-1.59354E 01	-1.37042E-41	0.0
66	-1.57894E 01	-7.60000E-01	3.93812E 00
67	-1.57816E 01	7.60000E-01	3.93812E 00
68	-1.57737E 01	-7.60000E-01	3.93812E 00
69	-1.57658E 01	7.60000E-01	3.93812E 00
70	-1.56198E 01	-1.37042E-41	0.0
71	-1.54739E 01	7.60000E-01	3.93812E 00
72	-1.54660E 01	-7.60000E-01	3.93812E 00
73	-1.54581E 01	7.60000E-01	3.93812E 00
74	-1.54503E 01	-7.60000E-01	3.93812E 00
75	-1.53043E 01	-1.37042E-41	0.0
76	-1.51583E 01	7.60000E-01	3.93812E 00
77	-1.51505E 01	-7.60000E-01	3.93812E 00
78	-1.51426E 01	7.60000E-01	3.93812E 00
79	-1.51347E 01	-7.60000E-01	3.93812E 00
80	-1.49887E 01	-1.37042E-41	0.0
81	-1.48428E 01	7.60000E-01	3.93812E 00
82	-1.48349E 01	-7.60000E-01	3.93812E 00
83	-1.48270E 01	7.60000E-01	3.93812E 00
84	-1.48191E 01	-7.60000E-01	3.93812E 00
85	-1.46732E 01	-1.37042E-41	0.0
86	-1.45272E 01	7.60000E-01	3.93812E 00
87	-1.45193E 01	-7.60000E-01	3.93812E 00
88	-1.45115E 01	7.60000E-01	3.93812E 00
89	-1.45036E 01	-7.60000E-01	3.93812E 00
90	-1.43576E 01	-1.37042E-41	0.0
91	-1.42117E 01	-7.60000E-01	3.93812E 00
92	-1.42038E 01	7.60000E-01	3.93812E 00
93	-1.41959E 01	-7.60000E-01	3.93812E 00
94	-1.41880E 01	7.60000E-01	3.93812E 00
95	-1.40421E 01	-1.37042E-41	0.0
96	-1.38961E 01	7.60000E-01	3.93812E 00
97	-1.38882E 01	-7.60000E-01	3.93812E 00
98	-1.38804E 01	7.60000E-01	3.93812E 00
99	-1.38725E 01	-7.60000E-01	3.93812E 00
100	-1.37265E 01	-1.37042E-41	0.0

TRANSDUCER NAME: ECOMMT TDL-200,TAPPED TRANSDUCER
DATE: JAN 23,1978
REF DES: MT2
TOTAL NUMBER OF ELECTRODE STRIPES: 634

SIZE	FSCM NO.	DRAWING NO.	REV
A	05869	1950529	
SCALE: NONE		SHEET	7

STRIPE NO.	DIM X STRIPE LOCATION	DIM Y BREAK LOCATION	DIM S STRIPE WIDTH
101	-1.35806E 01	-7.60000E-01	3.93812E 00
102	-1.35727E 01	7.60000E-01	3.93812E 00
103	-1.35648E 01	-7.60000E-01	3.93812E 00
104	-1.35569E 01	7.60000E-01	3.93812E 00
105	-1.34110E 01	-1.37042E-41	0.0
106	-1.32650E 01	7.60000E-01	3.93812E 00
107	-1.32571E 01	-7.60000E-01	3.93812E 00
108	-1.32493E 01	7.60000E-01	3.93812E 00
109	-1.32414E 01	-7.60000E-01	3.93812E 00
110	-1.30954E 01	-1.37042E-41	0.0
111	-1.29495E 01	7.60000E-01	3.93812E 00
112	-1.29416E 01	-7.60000E-01	3.93812E 00
113	-1.29337E 01	7.60000E-01	3.93812E 00
114	-1.29258E 01	-7.60000E-01	3.93812E 00
115	-1.27799E 01	-1.37042E-41	0.0
116	-1.26339E 01	7.60000E-01	3.93812E 00
117	-1.26260E 01	-7.60000E-01	3.93812E 00
118	-1.26182E 01	7.60000E-01	3.93812E 00
119	-1.26103E 01	-7.60000E-01	3.93812E 00
120	-1.24643E 01	-1.37042E-41	0.0
121	-1.23184E 01	-7.60000E-01	3.93812E 00
122	-1.23105E 01	7.60000E-01	3.93812E 00
123	-1.23026E 01	-7.60000E-01	3.93812E 00
124	-1.22947E 01	7.60000E-01	3.93812E 00
125	-1.21488E 01	-1.37042E-41	0.0
126	-1.20028E 01	-7.60000E-01	3.93812E 00
127	-1.19949E 01	7.60000E-01	3.93812E 00
128	-1.19871E 01	-7.60000E-01	3.93812E 00
129	-1.19792E 01	7.60000E-01	3.93812E 00
130	-1.18332E 01	-1.37042E-41	0.0
131	-1.16873E 01	-7.60000E-01	3.93812E 00
132	-1.16794E 01	7.60000E-01	3.93812E 00
133	-1.16715E 01	-7.60000E-01	3.93812E 00
134	-1.16636E 01	7.60000E-01	3.93812E 00
135	-1.15177E 01	-1.37042E-41	0.0
136	-1.13717E 01	-7.60000E-01	3.93812E 00
137	-1.13638E 01	7.60000E-01	3.93812E 00
138	-1.13559E 01	-7.60000E-01	3.93812E 00
139	-1.13481E 01	7.60000E-01	3.93812E 00
140	-1.12021E 01	-1.37042E-41	0.0
141	-1.10561E 01	7.60000E-01	3.93812E 00
142	-1.10483E 01	-7.60000E-01	3.93812E 00
143	-1.10404E 01	7.60000E-01	3.93812E 00
144	-1.10325E 01	-7.60000E-01	3.93812E 00
145	-1.08866E 01	-1.37042E-41	0.0
146	-1.07406E 01	7.60000E-01	3.93812E 00
147	-1.07327E 01	-7.60000E-01	3.93812E 00
148	-1.07248E 01	7.60000E-01	3.93812E 00
149	-1.07170E 01	-7.60000E-01	3.93812E 00
150	-1.05719E 01	-1.37042E-41	0.0

TRANSDUCER NAME: ECOMMT TDL-200,TAPPED TRANSDUCER
DATE: JAN 23,1978
REF DES: MT2
TOTAL NUMBER OF ELECTRODE STRIPES: 634

SIZE	FSCM NO.	DRAWING NO.	REV
A	05869	1950529	
SCALE: NONE		SHEET	8

STRIPE NO.	DIM X STRIPE LOCATION	DIM Y BREAK LOCATION	DIM S STRIPE WIDTH
151	-1.04250E 01	-7.60000E-01	3.93812E 00
152	-1.04172E 01	7.60000E-01	3.93812E 00
153	-1.04093E 01	-7.60000E-01	3.93812E 00
154	-1.04014E 01	7.60000E-01	3.93812E 00
155	-1.02555E 01	-1.37042E-41	0.0
156	-1.01095E 01	7.60000E-01	3.93812E 00
157	-1.01016E 01	-7.60000E-01	3.93812E 00
158	-1.00937E 01	7.60000E-01	3.93812E 00
159	-1.00859E 01	-7.60000E-01	3.93812E 00
160	-9.93990E 00	-1.37042E-41	0.0
161	-9.79394E 00	7.60000E-01	3.93812E 00
162	-9.78606E 00	-7.60000E-01	3.93812E 00
163	-9.77818E 00	7.60000E-01	3.93812E 00
164	-9.77031E 00	-7.60000E-01	3.93812E 00
165	-9.62435E 00	-1.37042E-41	0.0
166	-9.47838E 00	7.60000E-01	3.93812E 00
167	-9.47051E 00	-7.60000E-01	3.93812E 00
168	-9.46263E 00	7.60000E-01	3.93812E 00
169	-9.45476E 00	-7.60000E-01	3.93812E 00
170	-9.30879E 00	-1.37042E-41	0.0
171	-9.16283E 00	-7.60000E-01	3.93812E 00
172	-9.15496E 00	7.60000E-01	3.93812E 00
173	-9.14708E 00	-7.60000E-01	3.93812E 00
174	-9.13920E 00	7.60000E-01	3.93812E 00
175	-8.99324E 00	-1.37042E-41	0.0
176	-8.84728E 00	7.60000E-01	3.93812E 00
177	-8.83940E 00	-7.60000E-01	3.93812E 00
178	-8.83153E 00	7.60000E-01	3.93812E 00
179	-8.82365E 00	-7.60000E-01	3.93812E 00
180	-8.67769E 00	-1.37042E-41	0.0
181	-8.53173E 00	-7.60000E-01	3.93812E 00
182	-8.52385E 00	7.60000E-01	3.93812E 00
183	-8.51597E 00	-7.60000E-01	3.93812E 00
184	-8.50810E 00	7.60000E-01	3.93812E 00
185	-8.36214E 00	-1.37042E-41	0.0
186	-8.21618E 00	-7.60000E-01	3.93812E 00
187	-8.20830E 00	7.60000E-01	3.93812E 00
188	-8.20042E 00	-7.60000E-01	3.93812E 00
189	-8.19255E 00	7.60000E-01	3.93812E 00
190	-8.04659E 00	-1.37042E-41	0.0
191	-7.90062E 00	7.60000E-01	3.93812E 00
192	-7.89275E 00	-7.60000E-01	3.93812E 00
193	-7.88487E 00	7.60000E-01	3.93812E 00
194	-7.87699E 00	-7.60000E-01	3.93812E 00
195	-7.73103E 00	-1.37042E-41	0.0
196	-7.58507E 00	7.60000E-01	3.93812E 00
197	-7.57719E 00	-7.60000E-01	3.93812E 00
198	-7.56932E 00	7.60000E-01	3.93812E 00
199	-7.56144E 00	-7.60000E-01	3.93812E 00
200	-7.41548E 00	-1.37042E-41	0.0

TRANSDUCER NAME: ECOMMT TDL-200,TAPPED TRANSDUCER
DATE: JAN 23,1978
REF DES: MT2
TOTAL NUMBER OF ELECTRODE STRIPES: 634

SIZE	FSCM NO.	DRAWING NO.	REV
A	05869	1950529	
SCALE: NONE		SHEET	9

STRIPE NO.	DIM X STRIPE LOCATION	DIM Y BREAK LOCATION	DIM S STRIPE WIDTH
201	-7.26952E 00	-7.60000E-01	3.93812E 00
202	-7.26164E 00	7.60000E-01	3.93812E 00
203	-7.25377E 00	-7.60000E-01	3.93812E 00
204	-7.24589E 00	7.60000E-01	3.93812E 00
205	-7.09993E 00	-1.37042E-41	0.0
206	-6.95397E 00	-7.60000E-01	3.93812E 00
207	-6.94609E 00	7.60000E-01	3.93812E 00
208	-6.93821E 00	-7.60000E-01	3.93812E 00
209	-6.93034E 00	7.60000E-01	3.93812E 00
210	-6.78438E 00	-1.37042E-41	0.0
211	-6.63841E 00	-7.60000E-01	3.93812E 00
212	-6.63054E 00	7.60000E-01	3.93812E 00
213	-6.62266E 00	-7.60000E-01	3.93812E 00
214	-6.61479E 00	7.60000E-01	3.93812E 00
215	-6.46882E 00	-1.37042E-41	0.0
216	-6.32286E 00	7.60000E-01	3.93812E 00
217	-6.31499E 00	-7.60000E-01	3.93812E 00
218	-6.30711E 00	7.60000E-01	3.93812E 00
219	-6.29923E 00	-7.60000E-01	3.93812E 00
220	-6.15327E 00	-1.37042E-41	0.0
221	-6.00731E 00	-7.60000E-01	3.93812E 00
222	-5.99943E 00	7.60000E-01	3.93812E 00
223	-5.99156E 00	-7.60000E-01	3.93812E 00
224	-5.98368E 00	7.60000E-01	3.93812E 00
225	-5.83772E 00	-1.37042E-41	0.0
226	-5.69176E 00	7.60000E-01	3.93812E 00
227	-5.68388E 00	-7.60000E-01	3.93812E 00
228	-5.67600E 00	7.60000E-01	3.93812E 00
229	-5.66813E 00	-7.60000E-01	3.93812E 00
230	-5.52217E 00	-1.37042E-41	0.0
231	-5.37620E 00	-7.60000E-01	3.93812E 00
232	-5.36833E 00	7.60000E-01	3.93812E 00
233	-5.36045E 00	-7.60000E-01	3.93812E 00
234	-5.35258E 00	7.60000E-01	3.93812E 00
235	-5.20661E 00	-1.37042E-41	0.0
236	-5.06065E 00	7.60000E-01	3.93812E 00
237	-5.05278E 00	-7.60000E-01	3.93812E 00
238	-5.04490E 00	7.60000E-01	3.93812E 00
239	-5.03702E 00	-7.60000E-01	3.93812E 00
240	-4.89106E 00	-1.37042E-41	0.0
241	-4.74510E 00	7.60000E-01	3.93812E 00
242	-4.73722E 00	-7.60000E-01	3.93812E 00
243	-4.72935E 00	7.60000E-01	3.93812E 00
[illegible]	-4.72147E 00	-7.60000E-01	3.93812E 00
[illegible]	-4.57551E 00	-1.37042E-41	0.0
[illegible]	-4.42955E 00	-7.60000E-01	3.93812E 00
[illegible]	-4.42167E 00	7.60000E-01	3.93812E 00
[illegible]	-4.41379E 00	-7.60000E-01	3.93812E 00
[illegible]	-4.40592E 00	7.60000E-01	3.93812E 00
[illegible]	-4.25996E 00	-1.37042E-41	0.0

[illegible] ECOMMT TDL-200,TAPPED TRANSDUCER
[illegible]
[illegible]
[illegible] ELECTRODE STRIPES: 634

SIZE FSCM NO. DRAWING NO. REV
A 05869 1950529
SCALE: NONE SHEET 10

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PHOTOLITHOGRAPHIC TECHNIQUES FOR SURFACE ACOUSTIC WAVE (SAW) DE--ETC(U)
DEC 78 A W DOZIER DAAB07-75-C-0044
UNCLASSIFIED FR-79-12-40-VOL-1 DELET-TR-75-0044-F-VOL-1 NL

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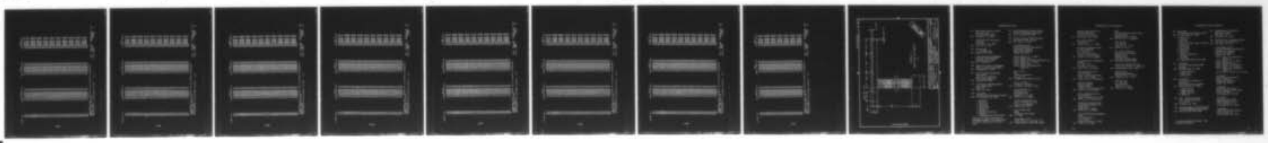

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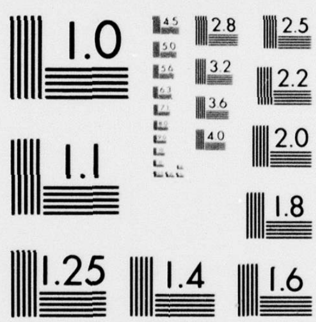


MICROCOPY RESOLUTION TEST CHART

NATIONAL BUREAU OF STANDARDS-1963-A

STRIPE NO.	DIM X STRIPE LOCATION	DIM Y BREAK LOCATION	DIM S STRIPE WIDTH
251	-4.11399E 00	-7.60000E-01	3.93812E 00
252	-4.10612E 00	7.60000E-01	3.93812E 00
253	-4.09824E 00	-7.60000E-01	3.93812E 00
254	-4.09037E 00	7.60000E-01	3.93812E 00
255	-3.94440E 00	-1.37042E-41	0.0
256	-3.79844E 00	-7.60000E-01	3.93812E 00
257	-3.79057E 00	7.60000E-01	3.93812E 00
258	-3.78269E 00	-7.60000E-01	3.93812E 00
259	-3.77481E 00	7.60000E-01	3.93812E 00
260	-3.62885E 00	-1.37042E-41	0.0
261	-3.48289E 00	-7.60000E-01	3.93812E 00
262	-3.47501E 00	7.60000E-01	3.93812E 00
263	-3.46714E 00	-7.60000E-01	3.93812E 00
264	-3.45926E 00	7.60000E-01	3.93812E 00
265	-3.31330E 00	-1.37042E-41	0.0
266	-3.16734E 00	-7.60000E-01	3.93812E 00
267	-3.15946E 00	7.60000E-01	3.93812E 00
268	-3.15158E 00	-7.60000E-01	3.93812E 00
269	-3.14371E 00	7.60000E-01	3.93812E 00
270	-2.99775E 00	-1.37042E-41	0.0
271	-2.85179E 00	7.60000E-01	3.93812E 00
272	-2.84391E 00	-7.60000E-01	3.93812E 00
273	-2.83603E 00	7.60000E-01	3.93812E 00
274	-2.82816E 00	-7.60000E-01	3.93812E 00
275	-2.68219E 00	-1.37042E-41	0.0
276	-2.53623E 00	-7.60000E-01	3.93812E 00
277	-2.52836E 00	7.60000E-01	3.93812E 00
278	-2.52048E 00	-7.60000E-01	3.93812E 00
279	-2.51260E 00	7.60000E-01	3.93812E 00
280	-2.36664E 00	-1.37042E-41	0.0
281	-2.22068E 00	7.60000E-01	3.93812E 00
282	-2.21280E 00	-7.60000E-01	3.93812E 00
283	-2.20493E 00	7.60000E-01	3.93812E 00
284	-2.19705E 00	-7.60000E-01	3.93812E 00
285	-2.05109E 00	-1.37042E-41	0.0
286	-1.90513E 00	7.60000E-01	3.93812E 00
287	-1.89725E 00	-7.60000E-01	3.93812E 00
288	-1.88938E 00	7.60000E-01	3.93812E 00
289	-1.88150E 00	-7.60000E-01	3.93812E 00
290	-1.73554E 00	-1.37042E-41	0.0
291	-1.58958E 00	7.60000E-01	3.93812E 00
292	-1.58170E 00	-7.60000E-01	3.93812E 00
293	-1.57382E 00	7.60000E-01	3.93812E 00
294	-1.56595E 00	-7.60000E-01	3.93812E 00
295	-1.41998E 00	-1.37042E-41	0.0
296	-1.27402E 00	7.60000E-01	3.93812E 00
297	-1.26615E 00	-7.60000E-01	3.93812E 00
298	-1.25827E 00	7.60000E-01	3.93812E 00
299	-1.25039E 00	-7.60000E-01	3.93812E 00
300	-1.10443E 00	-1.37042E-41	0.0

TRANSDUCER NAME: ECOMMT TDL-200,TAPPED TRANSDUCER
DATE: JAN 23,1978
REF DES: MT2
TOTAL NUMBER OF ELECTRODE STRIPES: 634

SIZE	FSCM NO.	DRAWING NO.	REV
A	05869	1950529	
SCALE: NONE		SHEET	11

STRIPE NO.	DIM X STRIPE LOCATION	DIM Y BREAK LOCATION	DIM S STRIPE WIDTH
301	-9.58471E-01	-7.60000E-01	3.93812E 00
302	-9.50595E-01	7.60000E-01	3.93812E 00
303	-9.42719E-01	-7.60000E-01	3.93812E 00
304	-9.34843E-01	7.60000E-01	3.93812E 00
305	-7.88881E-01	-1.37042E-41	0.0
306	-6.42919E-01	-7.60000E-01	3.93812E 00
307	-6.35043E-01	7.60000E-01	3.93812E 00
308	-6.27167E-01	-7.60000E-01	3.93812E 00
309	-6.19290E-01	7.60000E-01	3.93812E 00
310	-4.73329E-01	-1.37042E-41	0.0
311	-3.27367E-01	-7.60000E-01	3.93812E 00
312	-3.19490E-01	7.60000E-01	3.93812E 00
313	-3.11614E-01	-7.60000E-01	3.93812E 00
314	-3.03738E-01	7.60000E-01	3.93812E 00
315	-1.57776E-01	-1.37042E-41	0.0
316	-1.18144E-02	7.60000E-01	3.93812E 00
317	-3.93812E-03	-7.60000E-01	3.93812E 00
318	3.93812E-03	7.60000E-01	3.93812E 00
319	1.18144E-02	-7.60000E-01	3.93812E 00
320	1.57776E-01	-1.37042E-41	0.0
321	3.03738E-01	7.60000E-01	3.93812E 00
322	3.11614E-01	-7.60000E-01	3.93812E 00
323	3.19490E-01	7.60000E-01	3.93812E 00
324	3.27367E-01	-7.60000E-01	3.93812E 00
325	4.73329E-01	-1.37042E-41	0.0
326	6.19290E-01	7.60000E-01	3.93812E 00
327	6.27167E-01	-7.60000E-01	3.93812E 00
328	6.35043E-01	7.60000E-01	3.93812E 00
329	6.42919E-01	-7.60000E-01	3.93812E 00
330	7.88881E-01	-1.37042E-41	0.0
331	9.34843E-01	-7.60000E-01	3.93812E 00
332	9.42719E-01	7.60000E-01	3.93812E 00
333	9.50595E-01	-7.60000E-01	3.93812E 00
334	9.58471E-01	7.60000E-01	3.93812E 00
335	1.10443E 00	-1.37042E-41	0.0
336	1.25039E 00	7.60000E-01	3.93812E 00
337	1.25827E 00	-7.60000E-01	3.93812E 00
338	1.26615E 00	7.60000E-01	3.93812E 00
339	1.27402E 00	-7.60000E-01	3.93812E 00
340	1.41998E 00	-1.37042E-41	0.0
341	1.56595E 00	7.60000E-01	3.93812E 00
342	1.57382E 00	-7.60000E-01	3.93812E 00
343	1.58170E 00	7.60000E-01	3.93812E 00
344	1.58958E 00	-7.60000E-01	3.93812E 00
345	1.73554E 00	-1.37042E-41	0.0
346	1.88150E 00	-7.60000E-01	3.93812E 00
347	1.88938E 00	7.60000E-01	3.93812E 00
348	1.89725E 00	-7.60000E-01	3.93812E 00
349	1.90513E 00	7.60000E-01	3.93812E 00
350	2.05109E 00	-1.37042E-41	0.0

TRANSDUCER NAME: ECOMMT TDL-200,TAPPED TRANSDUCER
DATE: JAN 23,1978
REF DES: MT2
TOTAL NUMBER OF ELECTRODE STRIPES: 634

SIZE	FSCM NO.	DRAWING NO.	REV
A	05869	1950529	
SCALE: NONE		SHEET	12

STRIPE NO.	DIM X STRIPE LOCATION	DIM Y BREAK LOCATION	DIM S STRIPE WIDTH
351	2.19705E 00	7.60000E-01	3.93812E 00
352	2.20493E 00	-7.60000E-01	3.93812E 00
353	2.21280E 00	7.60000E-01	3.93812E 00
354	2.22068E 00	-7.60000E-01	3.93812E 00
355	2.36664E 00	-1.37042E-41	0.0
356	2.51260E 00	7.60000E-01	3.93812E 00
357	2.52048E 00	-7.60000E-01	3.93812E 00
358	2.52836E 00	7.60000E-01	3.93812E 00
359	2.53623E 00	-7.60000E-01	3.93812E 00
360	2.68219E 00	-1.37042E-41	0.0
361	2.82816E 00	-7.60000E-01	3.93812E 00
362	2.83603E 00	7.60000E-01	3.93812E 00
363	2.84391E 00	-7.60000E-01	3.93812E 00
364	2.85179E 00	7.60000E-01	3.93812E 00
365	2.99775E 00	-1.37042E-41	0.0
366	3.14371E 00	-7.60000E-01	3.93812E 00
367	3.15158E 00	7.60000E-01	3.93812E 00
368	3.15946E 00	-7.60000E-01	3.93812E 00
369	3.16734E 00	7.60000E-01	3.93812E 00
370	3.31330E 00	-1.37042E-41	0.0
371	3.45926E 00	7.60000E-01	3.93812E 00
372	3.46714E 00	-7.60000E-01	3.93812E 00
373	3.47501E 00	7.60000E-01	3.93812E 00
374	3.48289E 00	-7.60000E-01	3.93812E 00
375	3.62885E 00	-1.37042E-41	0.0
376	3.77481E 00	-7.60000E-01	3.93812E 00
377	3.78269E 00	7.60000E-01	3.93812E 00
378	3.79057E 00	-7.60000E-01	3.93812E 00
379	3.79844E 00	7.60000E-01	3.93812E 00
380	3.94440E 00	-1.37042E-41	0.0
381	4.09037E 00	-7.60000E-01	3.93812E 00
382	4.09824E 00	7.60000E-01	3.93812E 00
383	4.10612E 00	-7.60000E-01	3.93812E 00
384	4.11399E 00	7.60000E-01	3.93812E 00
385	4.25996E 00	-1.37042E-41	0.0
386	4.40592E 00	7.60000E-01	3.93812E 00
387	4.41379E 00	-7.60000E-01	3.93812E 00
388	4.42167E 00	7.60000E-01	3.93812E 00
389	4.42955E 00	-7.60000E-01	3.93812E 00
390	4.57551E 00	-1.37042E-41	0.0
391	4.72147E 00	-7.60000E-01	3.93812E 00
392	4.72935E 00	7.60000E-01	3.93812E 00
393	4.73722E 00	-7.60000E-01	3.93812E 00
394	4.74510E 00	7.60000E-01	3.93812E 00
395	4.89106E 00	-1.37042E-41	0.0
396	5.03702E 00	7.60000E-01	3.93812E 00
397	5.04490E 00	-7.60000E-01	3.93812E 00
398	5.05278E 00	7.60000E-01	3.93812E 00
399	5.06065E 00	-7.60000E-01	3.93812E 00
400	5.20661E 00	-1.37042E-41	0.0

TRANSDUCER NAME: ECOMMT TDL-200,TAPPED TRANSDUCER
DATE: JAN 23,1978
REF DES: MT2
TOTAL NUMBER OF ELECTRODE STRIPES: 634

SIZE	FSCM NO.	DRAWING NO.	REV
A	05669	1950529	
SCALE: NONE		SHEET	13

STRIPE NO.	DIM X STRIPE LOCATION	DIM Y BREAK LOCATION	DIM S STRIPE WIDTH
401	5.35258E 00	-7.60000E-01	3.93812E 00
402	5.36045E 00	7.60000E-01	3.93812E 00
403	5.36833E 00	-7.60000E-01	3.93812E 00
404	5.37620E 00	7.60000E-01	3.93812E 00
405	5.52217E 00	-1.37042E-41	0.0
406	5.66813E 00	-7.60000E-01	3.93812E 00
407	5.67600E 00	7.60000E-01	3.93812E 00
408	5.68388E 00	-7.60000E-01	3.93812E 00
409	5.69176E 00	7.60000E-01	3.93812E 00
410	5.83772E 00	-1.37042E-41	0.0
411	5.98368E 00	7.60000E-01	3.93812E 00
412	5.99156E 00	-7.60000E-01	3.93812E 00
413	5.99943E 00	7.60000E-01	3.93812E 00
414	6.00731E 00	-7.60000E-01	3.93812E 00
415	6.15327E 00	-1.37042E-41	0.0
416	6.29923E 00	-7.60000E-01	3.93812E 00
417	6.30711E 00	7.60000E-01	3.93812E 00
418	6.31499E 00	-7.60000E-01	3.93812E 00
419	6.32286E 00	7.60000E-01	3.93812E 00
420	6.46882E 00	-1.37042E-41	0.0
421	6.61479E 00	-7.60000E-01	3.93812E 00
422	6.62266E 00	7.60000E-01	3.93812E 00
423	6.63054E 00	-7.60000E-01	3.93812E 00
424	6.63841E 00	7.60000E-01	3.93812E 00
425	6.78438E 00	-1.37042E-41	0.0
426	6.93034E 00	-7.60000E-01	3.93812E 00
427	6.93821E 00	7.60000E-01	3.93812E 00
428	6.94609E 00	-7.60000E-01	3.93812E 00
429	6.95397E 00	7.60000E-01	3.93812E 00
430	7.09993E 00	-1.37042E-41	0.0
431	7.24589E 00	-7.60000E-01	3.93812E 00
432	7.25377E 00	7.60000E-01	3.93812E 00
433	7.26164E 00	-7.60000E-01	3.93812E 00
434	7.26952E 00	7.60000E-01	3.93812E 00
435	7.41548E 00	-1.37042E-41	0.0
436	7.56144E 00	7.60000E-01	3.93812E 00
437	7.56932E 00	-7.60000E-01	3.93812E 00
438	7.57719E 00	7.60000E-01	3.93812E 00
439	7.58507E 00	-7.60000E-01	3.93812E 00
440	7.73103E 00	-1.37042E-41	0.0
441	7.87699E 00	-7.60000E-01	3.93812E 00
442	7.88487E 00	7.60000E-01	3.93812E 00
443	7.89275E 00	-7.60000E-01	3.93812E 00
444	7.90062E 00	7.60000E-01	3.93812E 00
445	8.04659E 00	-1.37042E-41	0.0
446	8.19255E 00	-7.60000E-01	3.93812E 00
447	8.20042E 00	7.60000E-01	3.93812E 00
448	8.20830E 00	-7.60000E-01	3.93812E 00
449	8.21618E 00	7.60000E-01	3.93812E 00
450	8.36214E 00	-1.37042E-41	0.0

TRANSDUCER NAME: ECOMMT TDL-200,TAPPED TRANSDUCER
DATE: JAN 23,1978
REF DES: MT2
TOTAL NUMBER OF ELECTRODE STRIPES: 634

SIZE	FSCM NO.	DRAWING NO.	REV
A	05869	1950529	
SCALE: NONE		SHEET	14

STRIPE NO.	DIM X STRIPE LOCATION	DIM Y BREAK LOCATION	DIM S STRIPE WIDTH
451	8.50810E 00	7.60000E-01	3.93812E 00
452	8.51597E 00	-7.60000E-01	3.93812E 00
453	8.52385E 00	7.60000E-01	3.93812E 00
454	8.53173E 00	-7.60000E-01	3.93812E 00
455	8.67769E 00	-1.37042E-41	0.0
456	8.82365E 00	7.60000E-01	3.93812E 00
457	8.83153E 00	-7.60000E-01	3.93812E 00
458	8.83940E 00	7.60000E-01	3.93812E 00
459	8.84728E 00	-7.60000E-01	3.93812E 00
460	8.99324E 00	-1.37042E-41	0.0
461	9.13920E 00	7.60000E-01	3.93812E 00
462	9.14708E 00	-7.60000E-01	3.93812E 00
463	9.15496E 00	7.60000E-01	3.93812E 00
464	9.16283E 00	-7.60000E-01	3.93812E 00
465	9.30879E 00	-1.37042E-41	0.0
466	9.45476E 00	-7.60000E-01	3.93812E 00
467	9.46263E 00	7.60000E-01	3.93812E 00
468	9.47051E 00	-7.60000E-01	3.93812E 00
469	9.47838E 00	7.60000E-01	3.93812E 00
470	9.62435E 00	-1.37042E-41	0.0
471	9.77031E 00	-7.60000E-01	3.93812E 00
472	9.77818E 00	7.60000E-01	3.93812E 00
473	9.78606E 00	-7.60000E-01	3.93812E 00
474	9.79394E 00	7.60000E-01	3.93812E 00
475	9.93990E 00	-1.37042E-41	0.0
476	1.00859E 01	7.60000E-01	3.93812E 00
477	1.00937E 01	-7.60000E-01	3.93812E 00
478	1.01016E 01	7.60000E-01	3.93812E 00
479	1.01095E 01	-7.60000E-01	3.93812E 00
480	1.02555E 01	-1.37042E-41	0.0
481	1.04014E 01	-7.60000E-01	3.93812E 00
482	1.04093E 01	7.60000E-01	3.93812E 00
483	1.04172E 01	-7.60000E-01	3.93812E 00
484	1.04250E 01	7.60000E-01	3.93812E 00
485	1.05710E 01	-1.37042E-41	0.0
486	1.07170E 01	7.60000E-01	3.93812E 00
487	1.07248E 01	-7.60000E-01	3.93812E 00
488	1.07327E 01	7.60000E-01	3.93812E 00
489	1.07406E 01	-7.60000E-01	3.93812E 00
490	1.08866E 01	-1.37042E-41	0.0
491	1.10325E 01	7.60000E-01	3.93812E 00
492	1.10404E 01	-7.60000E-01	3.93812E 00
493	1.10483E 01	7.60000E-01	3.93812E 00
494	1.10561E 01	-7.60000E-01	3.93812E 00
495	1.12021E 01	-1.37042E-41	0.0
496	1.13481E 01	-7.60000E-01	3.93812E 00
497	1.13559E 01	7.60000E-01	3.93812E 00
498	1.13638E 01	-7.60000E-01	3.93812E 00
499	1.13717E 01	7.60000E-01	3.93812E 00
500	1.15177E 01	-1.37042E-41	0.0

TRANSDUCER NAME: ECOMMT TDL-200,TAPPED TRANSDUCER
DATE: JAN 23,1978
REF DES: MT2
TOTAL NUMBER OF ELECTRODE STRIPES: 634

SIZE	FSCM NO.	DRAWING NO.	REV
A	05869	1950529	
SCALE: NONE		SHEET	15

STRIPE NO.	DIM X STRIPE LOCATION	DIM Y BREAK LOCATION	DIM S STRIPE WIDTH
501	1.16636E 01	7.60000E-01	3.93812E 00
502	1.16715E 01	-7.60000E-01	3.93812E 00
503	1.16794E 01	7.60000E-01	3.93812E 00
504	1.16873E 01	-7.60000E-01	3.93812E 00
505	1.18332E 01	-1.37042E-41	0.0
506	1.19792E 01	-7.60000E-01	3.93812E 00
507	1.19871E 01	7.60000E-01	3.93812E 00
508	1.19949E 01	-7.60000E-01	3.93812E 00
509	1.20028E 01	7.60000E-01	3.93812E 00
510	1.21488E 01	-1.37042E-41	0.0
511	1.22947E 01	-7.60000E-01	3.93812E 00
512	1.23026E 01	7.60000E-01	3.93812E 00
513	1.23105E 01	-7.60000E-01	3.93812E 00
514	1.23184E 01	7.60000E-01	3.93812E 00
515	1.24643E 01	-1.37042E-41	0.0
516	1.26103E 01	-7.60000E-01	3.93812E 00
517	1.26182E 01	7.60000E-01	3.93812E 00
518	1.26260E 01	-7.60000E-01	3.93812E 00
519	1.26339E 01	7.60000E-01	3.93812E 00
520	1.27799E 01	-1.37042E-41	0.0
521	1.29258E 01	7.60000E-01	3.93812E 00
522	1.29337E 01	-7.60000E-01	3.93812E 00
523	1.29416E 01	7.60000E-01	3.93812E 00
524	1.29495E 01	-7.60000E-01	3.93812E 00
525	1.30954E 01	-1.37042E-41	0.0
526	1.32414E 01	-7.60000E-01	3.93812E 00
527	1.32493E 01	7.60000E-01	3.93812E 00
528	1.32571E 01	-7.60000E-01	3.93812E 00
529	1.32650E 01	7.60000E-01	3.93812E 00
530	1.34110E 01	-1.37042E-41	0.0
531	1.35569E 01	-7.60000E-01	3.93812E 00
532	1.35648E 01	7.60000E-01	3.93812E 00
533	1.35727E 01	-7.60000E-01	3.93812E 00
534	1.35806E 01	7.60000E-01	3.93812E 00
535	1.37265E 01	-1.37042E-41	0.0
536	1.38725E 01	-7.60000E-01	3.93812E 00
537	1.38804E 01	7.60000E-01	3.93812E 00
538	1.38882E 01	-7.60000E-01	3.93812E 00
539	1.38961E 01	7.60000E-01	3.93812E 00
540	1.40421E 01	-1.37042E-41	0.0
541	1.41880E 01	7.60000E-01	3.93812E 00
542	1.41959E 01	-7.60000E-01	3.93812E 00
543	1.42038E 01	7.60000E-01	3.93812E 00
544	1.42117E 01	-7.60000E-01	3.93812E 00
545	1.43576E 01	-1.37042E-41	0.0
546	1.45036E 01	7.60000E-01	3.93812E 00
547	1.45115E 01	-7.60000E-01	3.93812E 00
548	1.45193E 01	7.60000E-01	3.93812E 00
549	1.45272E 01	-7.60000E-01	3.93812E 00
550	1.46732E 01	-1.37042E-41	0.0

TRANSDUCER NAME: ECOMMT TDL-200,TAPPED TRANSDUCER
DATE: JAN 23,1978
REF DES: MT2
TOTAL NUMBER OF ELECTRODE STRIPES: 634

SIZE	FSCM NO.	DRAWING NO.	REV
A	05869	1950529	
SCALE: NONE		SHEET	16

STRIPE NO.	DIM X STRIPE LOCATION	DIM Y BREAK LOCATION	DIM S STRIPE WIDTH
551	1.48191E 01	-7.60000E-01	3.93812E 00
552	1.48270E 01	7.60000E-01	3.93812E 00
553	1.48349E 01	-7.60000E-01	3.93812E 00
554	1.48428E 01	7.60000E-01	3.93812E 00
555	1.49887E 01	-1.37042E-41	0.0
556	1.51347E 01	-7.60000E-01	3.93812E 00
557	1.51426E 01	7.60000E-01	3.93812E 00
558	1.51505E 01	-7.60000E-01	3.93812E 00
559	1.51583E 01	7.60000E-01	3.93812E 00
560	1.53043E 01	-1.37042E-41	0.0
561	1.54503E 01	7.60000E-01	3.93812E 00
562	1.54581E 01	-7.60000E-01	3.93812E 00
563	1.54660E 01	7.60000E-01	3.93812E 00
564	1.54739E 01	-7.60000E-01	3.93812E 00
565	1.56198E 01	-1.37042E-41	0.0
566	1.57658E 01	7.60000E-01	3.93812E 00
567	1.57737E 01	-7.60000E-01	3.93812E 00
568	1.57816E 01	7.60000E-01	3.93812E 00
569	1.57894E 01	-7.60000E-01	3.93812E 00
570	1.59354E 01	-1.37042E-41	0.0
571	1.60813E 01	-7.60000E-01	3.93812E 00
572	1.60892E 01	7.60000E-01	3.93812E 00
573	1.60971E 01	-7.60000E-01	3.93812E 00
574	1.61050E 01	7.60000E-01	3.93812E 00
575	1.62509E 01	-1.37042E-41	0.0
576	1.63969E 01	7.60000E-01	3.93812E 00
577	1.64048E 01	-7.60000E-01	3.93812E 00
578	1.64127E 01	7.60000E-01	3.93812E 00
579	1.64205E 01	-7.60000E-01	3.93812E 00
580	1.65665E 01	-1.37042E-41	0.0
581	1.67124E 01	-7.60000E-01	3.93812E 00
582	1.67203E 01	7.60000E-01	3.93812E 00
583	1.67282E 01	-7.60000E-01	3.93812E 00
584	1.67361E 01	7.60000E-01	3.93812E 00
585	1.68820E 01	-1.37042E-41	0.0
586	1.70280E 01	7.60000E-01	3.93812E 00
587	1.70359E 01	-7.60000E-01	3.93812E 00
588	1.70438E 01	7.60000E-01	3.93812E 00
589	1.70516E 01	-7.60000E-01	3.93812E 00
590	1.71976E 01	-1.37042E-41	0.0
591	1.73436E 01	-7.60000E-01	3.93812E 00
592	1.73514E 01	7.60000E-01	3.93812E 00
593	1.73593E 01	-7.60000E-01	3.93812E 00
594	1.73672E 01	7.60000E-01	3.93812E 00
595	1.75132E 01	-1.37042E-41	0.0
596	1.76591E 01	7.60000E-01	3.93812E 00
597	1.76670E 01	-7.60000E-01	3.93812E 00
598	1.76749E 01	7.60000E-01	3.93812E 00
599	1.76827E 01	-7.60000E-01	3.93812E 00
600	1.78287E 01	-1.37042E-41	0.0

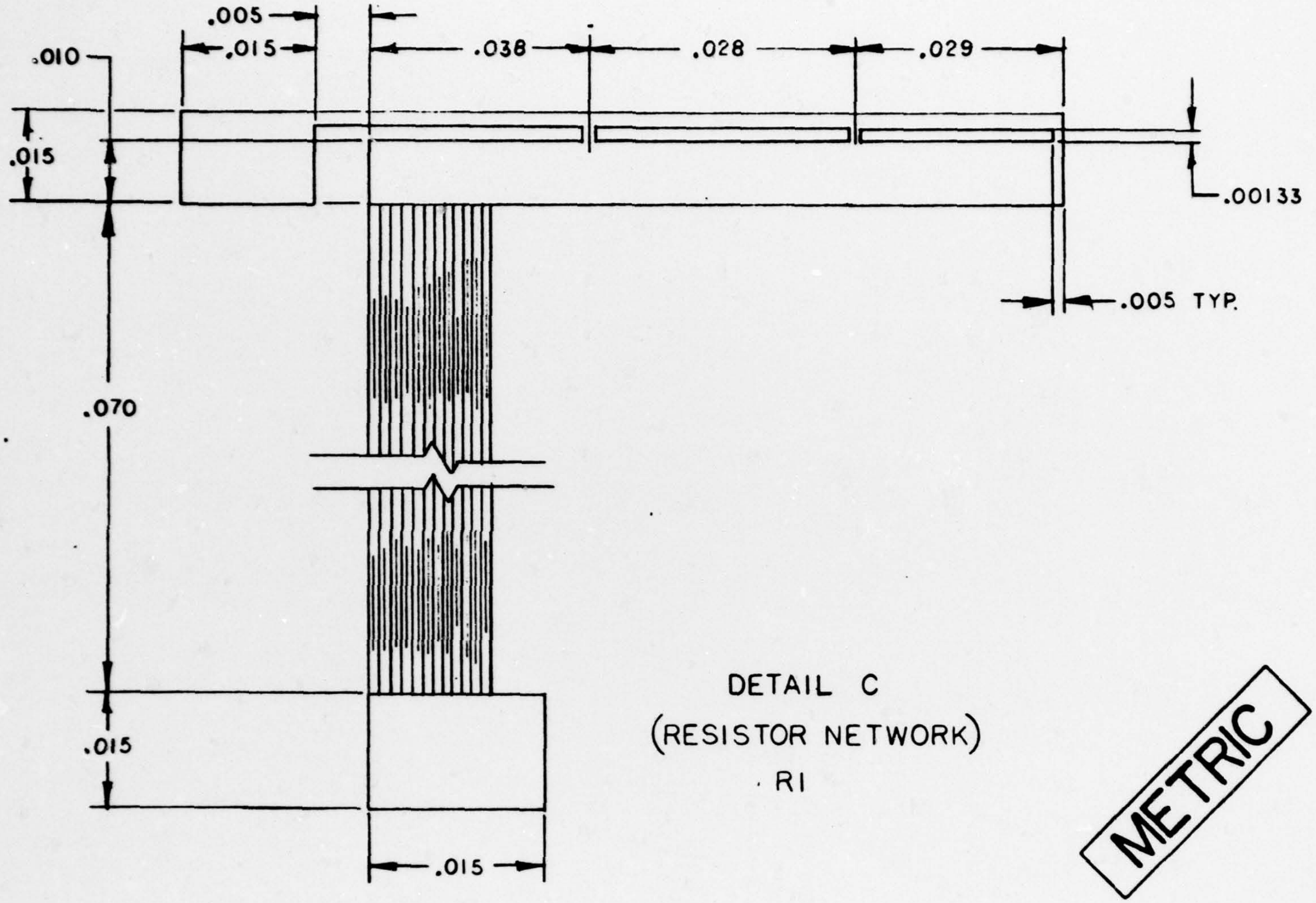
TRANSDUCER NAME: ECOMMT TDL-200,TAPPED TRANSDUCER
DATE: JAN 23,1978
REF DES: MT2
TOTAL NUMBER OF ELECTRODE STRIPES: 634

SIZE FSCM NO. DRAWING NO. REV
A 05869 1950529
SCALE: NONE SHEET 17

STRIPE NO.	DIM X STRIPE LOCATION	DIM Y BREAK LOCATION	DIM S STRIPE WIDTH
601	1.79747E 01	-7.60000E-01	3.93812E 00
602	1.79825E 01	7.60000E-01	3.93812E 00
603	1.79904E 01	-7.60000E-01	3.93812E 00
604	1.79983E 01	7.60000E-01	3.93812E 00
605	1.81443E 01	-1.37042E-41	0.0
606	1.82902E 01	-7.60000E-01	3.93812E 00
607	1.82981E 01	7.60000E-01	3.93812E 00
608	1.83060E 01	-7.60000E-01	3.93812E 00
609	1.83138E 01	7.60000E-01	3.93812E 00
610	1.84598E 01	-1.37042E-41	0.0
611	1.86058E 01	-7.60000E-01	3.93812E 00
612	1.86136E 01	7.60000E-01	3.93812E 00
613	1.86215E 01	-7.60000E-01	3.93812E 00
614	1.86294E 01	7.60000E-01	3.93812E 00
615	1.87754E 01	-1.37042E-41	0.0
616	1.89213E 01	-7.60000E-01	3.93812E 00
617	1.89292E 01	7.60000E-01	3.93812E 00
618	1.89371E 01	-7.60000E-01	3.93812E 00
619	1.89449E 01	7.60000E-01	3.93812E 00
620	1.90909E 01	-1.37042E-41	0.0
621	1.92369E 01	-7.60000E-01	3.93812E 00
622	1.92448E 01	7.60000E-01	3.93812E 00
623	1.92526E 01	-7.60000E-01	3.93812E 00
624	1.92605E 01	7.60000E-01	3.93812E 00
625	1.94065E 01	-1.37042E-41	0.0
626	1.95524E 01	-7.60000E-01	3.93812E 00
627	1.95603E 01	7.60000E-01	3.93812E 00
628	1.95682E 01	-7.60000E-01	3.93812E 00
629	1.95760E 01	7.60000E-01	3.93812E 00
630	1.97220E 01	-1.37042E-41	0.0
631	1.98680E 01	-7.60000E-01	3.93812E 00
632	1.98759E 01	7.60000E-01	3.93812E 00
633	1.98837E 01	-7.60000E-01	3.93812E 00
634	1.98916E 01	7.60000E-01	3.93812E 00

TRANSDUCER NAME: ECOMMT TDL-200,TAPPED TRANSDUCER
DATE: JAN 23,1978
REF DES: MT2
TOTAL NUMBER OF ELECTRODE STRIPES: 634

SIZE	FSCM NO.	DRAWING NO.	REV
A	05869	1950529	
SCALE: NONE		SHEET	18



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